THE AMERICAN GAS LIGHT JOURNAL

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXX. No. 25. Whole No. 1,515. | NEW YORK, MONDAY, JUNE 20, 1904. | $3 PER ANNUM. IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, New York.

Telephone.—2996 John.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $5 (£1—25 francs). All payments to be made in advance. Single copies, 10 cents.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Collections are invariably made directly from this office for subscriptions advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C. O. D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—
Where to Find the Western Gas Association's Exhibit and the Custodian Thereof at the World's Fair 961

NOTICE—
Twelfth Annual Meeting, Pacific Coast Gas Association 961
Special Editorial Correspondence, by Telegraph—Twenty-seventh Annual Meeting, Western Gas Association—Congress of American Gas Associations 961
*Shop Talks on Threads and Pipe Connections, by "G. D. R." 963
*Wrinkle Department, as Read at the Twenty seventh Annual Meeting, Western Gas Association, St. Louis, Mo., June, 1904 963
The Analytical Valuation of Gas Coals, by Mr. G. P. Lishman 965
An English Study of Some American Gas Works, by Mr. A. J. Walker 966
*Contents of the Question Box, Twentieth Annual Meeting, Ohio Gas Light Association—Continued from Page 931 967
The Mechanical Stoker and the Human Operator, by Mr. E. Yawger 968
Lutes, by Mr. S. S. Sadtler 970
Should Civil Engineering Schools be Modeled After West Point? 972
ITEMS OF INTEREST FROM VARIOUS LOCALITIES 972
Resignation of Mr. J. W. Hatstat—Gas for Hollidaysburg, Pa., from Altoona—Annual Meeting, Binghamton, N. Y.—Something from Louisville, Ky.—Resignation of Mr. A. B. Allen—Something from Rutland, Vt.—Annual Meeting, Nanaimo, B. C.—Annual Meeting, Georgetown, D. C.—A Truth from Greeley, Col.—Annual Meeting, Reading, Pa.—Public Lighting, San Francisco, Cal.—Personal—Electric Furnace for Laboratory Work—And Other Items.
The Market for Gas Securities 974

[OFFICIAL NOTICE.]

Where to Find the Western Gas Association's Exhibit, and the Custodian Thereof, at the World's Fair.

To the Fraternity: The exhibit of the Western Gas Association, at the World's Fair, St. Louis, is located in Section 33A, Liberal Arts Building, where Mr. Fred. R. Persons, who is in charge of the same, will always be on hand to receive visitors and to explain anything that requires explaining.

[NOTICE.]

Twelfth Annual Meeting, Pacific Coast Gas Association.

SAN FRANCISCO, CAL., June 6th, 1904.

To the Members of the Pacific Coast Gas Association: The Twelfth Annual Meeting of the Pacific Coast Gas Association will be held in the city of San Francisco, Tuesday and Wednesday, July 18th and 19th, 1904, and will be called to order at 10 A.M., Tuesday, by Mr. W. A. Aldrich, President. Place of meeting, Assembly Hall, Mechanics' Library, Post street, between Montgomery and Kearny.

The meeting of the Directors will be held Monday, July 17th, 1904, at 8 P.M., at the office of the Secretary, 427 Rialto Building, corner New Montgomery and Mission streets.

The following papers will be read:

President's Address, by Mr. W. A. Aldrich.

"Benefits of Consolidation," by Mr. John Martin.

"Some Practical Observations on the Flow of Gases in Pipes," by Mr. L. P. Lowe.

"Auld Lang Syne," by Mr. T. R. Parker.

"Notes Regarding California Petroleum," by Mr. P. W. Prutzman.

"Pressure Points," by Mr. E. C. Jones.

"From a Consumer's Standpoint," by Mr. John A. Britton.

"Effective Steam Plants for Gas Manufacture," by Mr. C. H. Pennoyer.

"American vs. English Gas Cooking Stoves," by Messrs. A. S. Main, Glasgow, Scotland; C. S. Barbour, London, England; H. Trenkamp, Cleveland, O.

"Wrinkles," edited by Mr. R. P. Valentine.

"Experiences," edited by Mr. Geo. S. Colquhoun.

"Novelty Department," edited by Mr. Geo. H. Hollidge.

"Question Box."

The annual banquet will be held Wednesday, July 19th, at 7 P.M.

The annual outing, for members, their families and friends, to Alum Rock, Santa Clara county, is set for Thursday, July 20th, particulars of which will be announced at meeting.

Arrangements have been made for a lecture on "Radium," to be given Tuesday evening, July 18th, by Prof. Edward Booth, of the University of California, to which members and their families will be admitted.

JOHN A. BRITTON,
Secretary.

LIBRARY OF CONGRESS
JUN 20 1904
SMITHSONIAN DEPOSIT

[Special Editorial Correspondence.—By Telegraph.]

TWENTY-SEVENTH ANNUAL MEETING, WESTERN GAS ASSOCIATION.

ST. LOUIS, MO., June 14th, 1904.

Dear JOURNAL: It may be good practice to hold the sessions of a technical association in, near or by the grounds covered by a World's Fair that is in session, but I venture the assertion that such location will not be selected in the near future by the Western Gas Association as a likely place for thought, reflection and connected results. Not that there was anything particularly amiss about the situation and its "environment," save that there was a trifle too much of "go" and "not go" at times. In other words, it was difficult to keep in harmony with that which was or should have been going on at a particular time. Of the Fair itself, enough has been written and time will have more to say about it, to preclude any particular mention of it here, save to remark that its scope and meaning are huge and that it is a pity more time was not allotted to the carrying out of its details. However, gas men have little to complain of respecting it, for the Gas Exhibit of the Western Gas Association is about as taking a thing as there is within the ground's inclosures, and the Southwest Pass lighthouse reproduction is doing good work from an instructive point of view to the visitors from the "interior" who, taking the word of the electricians, thought that gas "was out." But as my duty is to chronicle that which was done at the Western's meeting, the following summary gives a fair account. The meeting room was all that could be desired, even though the Hall of Congress in the Administration Building could hold many more when the Western's 27th annual session was called to order by the President, Mr. F. H. Shelton, of Philadelphia, at 10:30 this morning. About 200 awaited the fall of the gavel, and in that number were a majority whose names are known to about all of the rank and file. Secretary Dunbar, as placid and urbane as though World's Fair sessions were everyday occurrences, was in his usual place (and he had much to do) flanked by his senior officer, and between them the regular order was speedily reached and kept moving right along. First came the report of the Board of Directors, then the reports of the Secretary and Treasurer and the naming of Chicago as the meeting place for 1905. The disposition of these matters led to the address of President Shelton, whose sensible comments on the several matters that he so succinctly discussed therein well merited the hearty round of applause that greeted its conclusion. Next in order was the paper by Capt. Wm. Henry White, of New York, etc., whose running comments on the candle power of the gas of the near future resulted in a discussion which did not seem to have concord and harmony for its moving spirits. Nevertheless the Captain stood to his guns, and candor compels the statement that, despite his two recent excursions to and through the "Holy Lands," he still maintains a look of healthy worldliness. This concluded the morning session. The afternoon session was commenced at 2:30, by the consideration of the reports of the Library Committee and that on the Publication of Proceedings, after which the election of new members was considered. When the ballot had been cast the rolls were increased by the placing of 58 new actives and 23 associates. The report of the Committee on Memorials, which was presented by the Chairman, Mr. Paul Doty, sorrowfully showed that death had been all too busy during the year with his resistless attacks. No less than four tried and true ones were no more: General Asa S. Bushnell, a valued active member since 1883; General Andrew Hickenlooper, an honorary member since 1889; Henry B. Leach, whose name was placed on the honorary roll in 1890, and Thomas Littlehales, elected to active membership in 1898. The separate tributes paid to their respective memories well attest the esteem in which they were held. Next in order was the paper by President Shelton, whose theme was "Coal Projectors." He treated his subject in his usual incisive style and when the discussion thereon had been declared closed he was the recipient of a hearty vote of thanks, not only as President and committeman, but for his herculean work in planning and carrying out the gas exhibit that is such a feature of the Exposition. The excellent budget of "Wrinkles" presented by the Editor thereof, Mr. W. E. Steinwedell, was well appreciated; but the members did not so well like his resignation of the custody of the Wrinkle department. He would not be moved from his determination, however, and after he had been heartily thanked for his good work, Mr. W. A. Baehr, of St. Louis, was named to succeed him. The officers elected were:

President—Mr. O. O. Thwing, St. Louis, Mo.
First Vice-President—Mr. Paul Doty.
Second Vice-President—Mr. K. M. Mitchell, St. Joseph, Mo.
Secretary and Treasurer—Mr. J. W. Dunbar, New Albany, Ind.
Directors (to serve two years)—W. E. Steinwedell, Walton Clark, D. R. Warmington and George S. Clarke.

The weather was fair, the attendance is good, and the interest in the sessions was fairly well maintained.—S.

ST. LOUIS, June 16th, 1904.

Dear JOURNAL: The regulations prescribed for the reporting of the proceedings of the Congress of American Gas Associations, the first session of which was held yesterday in the Hall of Congress, where the meeting of the Western Gas Association was held, were such that I cannot send you much respecting it. The officials are prescribing and the patients are being dosed. The meeting was called to order by Mr. Rollin Norris, President of the American Gas Light Association, who, after a well put together explanation respecting the origin and carrying out of the thoughts that suggested the assemblying, called Mr. F. H. Shelton to the Chair, and delivered an address on what he termed the "Unsolved Problems of the Gas Industry"—which, indeed, are many. His address was one that showed no hasty preparation; and the attention it received was a guarantee that his hearers appreciated its thoughts. Then came the paper, by the indefatigable Shelton, on "The Labor Question." In connection with it he read an interesting letter from Sir George Livesey, the veteran and world-loved Manager of the South Metropolitan Gas Company, of London, England, descriptive of his Company's co-operative plans with its workmen. The discussion on the paper was a brisk one. The debate on the next paper, that by Mr. Ira C. Copley, of Aurora, Ills., on "Gas Inspection," was also a brisk one. The paper was quite like its clever, clean-cut author, right to the point. The Copley paper brought the first day of the Congress to a close. The visit to the "Pike" last evening, which corresponds (in some features) to the "Midway" of the late Chicago World's Fair, was a trifle damp, owing to a thunderstorm; but Pikes don't mind such atmospheric disturbances. I hope to get you the details of to-day's meeting and some word of the banquet at the Jefferson to-night if the powers will permit. —S.

ST. LOUIS, 6 P.M., June 16, 1904.

Dear JOURNAL: The second day's session of the Congress was called to order at 10:40 A.M. by President Norris, who asked Mr. W. A. Aldrich, President of the Pacific Coast Gas Association, to assume the direction of the meeting. The first subject considered was a short topic on the ventilation of retort houses, the discussion thereon being opened by Mr. Alfred Latz, of Chicago. This was followed by the paper by Mr. Alfred L. Doherty on "Gas Association Work." A good paper it was, too. One result of the debate was the adoption of a resolution, offered by Mr. Donald McDonald, of Louisville, Ky., authorizing the Presidents of the various Gas Associations of the country to appoint a committee, to consist of two members from each Association and three persons representing the gas business, but not connected with any of the Associations, to consider ways and means for consolidating all the Associations into one central Association; the Sec retary of the American Gas Light Association to be Secretary of the Committee. Mr. E. G. Pratt, President of the Wisconsin Gas Association, was in the Chair during the debate on this matter. If one is to form an opinion of the fate of this measure from what one heard in the ordinary face-to-face talk of the members, it is not likely to prevail. Mr. Donald McDonald, of Albany, N. Y., then read his paper on "Station Meters," and he is certainly deserving of hearty congratulation for its completeness and excellence. It is a gem, and will long keep a place in the literature concerned with gas apparatus. The report of the Committee on President's Address was followed by hearty and well deserved votes of thanks to the Committee of Arrangements (who were most assiduous and successful in their attention to the comfort and entertainment of the delegates and their guests), and officers as well, and the Congress was declared adjourned. The Fair is really a marvel, as the women folks are constantly attesting—quite a number of the gentler sex are here as delegates *pro tem.* There can be no fault found about the housing, and it can be truthfully said that the initial Congress of American Gas Associations was a success. I will try to get word to you to-morrow in time to print a line or two about the banquet.—S.

ST. LOUIS, 10 A.M., June 17, 1904.

Dear JOURNAL: The banquet last night was, to use the vernacular, "All to the good." About 225 were on hand to share its pleasures, and the proceedings were directed, from the chair of the toastmaster, by that most sedate of tourists, Capt. Wm. Henry White. The spirit of the board was fully as fraternal as that manifested at any time during the sessions of the Congress, with this further charm that ordinary delegates had a chance to speak to each other once in a while. You may put it down that the Central Association will require some close setting before it is safely hatched. The attendance throughout was good. Shelton was the lion of the week, and the East may say, "Well, we sent our quota." To-day will be devoted to sightseeing.—S.

[Prepared for the JOURNAL.]

Shop Talks on Threads and Pipe Connections.

By "G. D. R."

There are the square, the round, the oval, the V-shaped and several other forms of steam pipe threads to contend with in modern steam, water and gas pipe engineering. The abuse and use of the threads of the pipes, unions, elbows, tees, etc., have constituted important factors in the work of the engineer for years, particularly since the introduction of considerable modern apparatus. Often the engineer finds that the pipe defect is due to the poor material in the pipe or union, to improper adjusting and fitting, and sometimes to undue strains upon the system. For illustration, the system of pipe connection shown in Fig. 1 became fractured at *A*. An examination of the connections and adjustments revealed the fact that the elbow was weakened by the pressure exerted resulting from the incorrect alignment. The line of the two pipes failing to form a perfect angle, one pulled against the other, causing the fracture at *A*. Again, we have discovered poor adjusting of thread at *B*, Fig. 2, due to failure to turn the pipe in deep enough. The consequence is that, instead of several threads gripping the interior of the joint, only 2 or 3 threads make the bite, with the chances of the same permitting leakage and also breaking off. On the other hand I found a case in which the thread system was inserted too far. This had been broken off in the pipe, leaving what we might call a plug, as in Fig. 3. There remained enough room for the screwing in of two or three threads of the new union, and the workman let it go at this. The insufficiency of thread jointing due to the obstruction caused constant leaking, which was corrected by taking the combination apart and cutting out the remnants of the plug.

Grooving.—Steam and water pipe engineers are always bothered more or less by the mechanical grooving or gouging of thread systems of joints. The idea is shown in Fig. 4. As is known to the fraternity, corrosive factors, rusts and mechanical action will now and then cause havoc to occur in certain connections under certain conditions. Usually it is the pipe systems in the out-of-the-way places, in damp, dark corners, where there is constant moisture, that cause trouble. I have seen instances in which the destructive corrosive element would work its way in channel-like form from the pipe base of the thread end. The illustration gives an idea of the snake-like form usually assumed by the channel, or in reality flattened place, as at *C*. No amount of lead will rectify this. About the only way to do is to remove the pipe section and cut a new thread, removing the affected part.

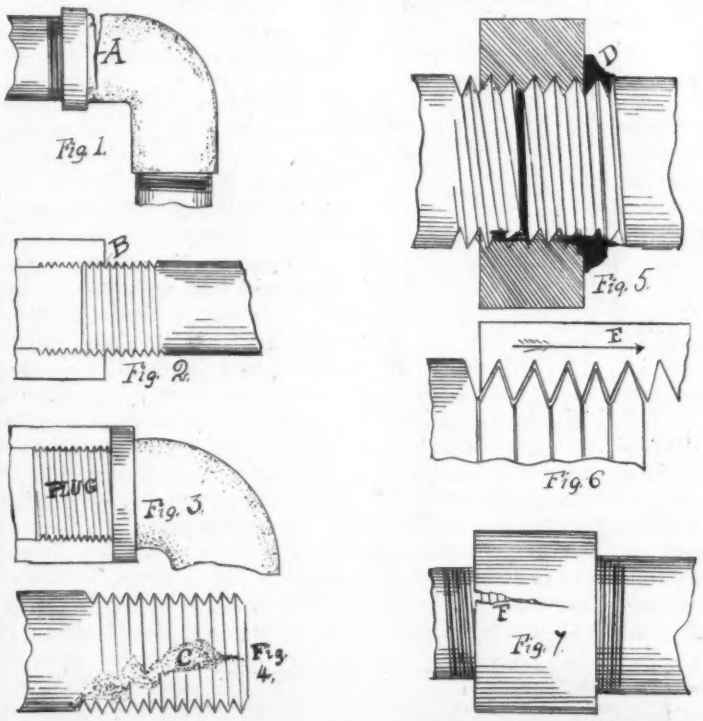
Accumulated Foreign Matter.—Foreign substances are quite sure to gather in remote places in pipe systems, regardless of precautions taken by the steam pipe engineer when he adjusts the system.

Your correspondent has seen most perfect adjustments well on the way to ruin through the neglect of the users. It seems to be taken for granted, when the pipes are once adjusted, that there need be no further care given, and that nothing is required to be done until a leak or fracture happens, requiring the services of the steam fitter. In many places in steam plants, houses, offices, public buildings, etc , one finds conditions in which pipes are used where foreign collections of stuffs are favored. In a flour mill, for example, I found fine sifting of flour dust packed hard about a pipe as at *D*, Fig. 5. Someone had at one time cemented the pipes and some cement was applied directly on top of the dirt-colored, flour stuff. The process of internal corroding started in, and little drops of moisture oozed through the pin holes in the plastered combination. These oozings commenced to form drops and the drops would occasionally fall to the white piles of flour in process of manufacture. The ooze drops were black as dirty water, oil and general dirt could make them, and a single drop would stain a quarter of a barrel of pure, white flour. We rectified this by removing the joint and recutting the threads.

Tendency to Work Off.—The general tendency is for the threaded section of anything to work away from the screw head, providing that there is no grip obtained at some time by frictional contact. This idea is presented in Fig. 6. The pipe is illustrated as being loosely screwed, as at *E*.

If no other element existed this threaded section would work itself in the direction of the arrow, caused by the incline of the tapering threads, if the threads are smooth, slight oiled, and there is no direct hindrance. The tendency arises from the jarring constantly prevailing, causing the vibration of the parts and the shifting of same. They do not shift to a tightening point but to a loosening point and, therefore, work free. The steam engineers overcome this difficulty by use of lead, by screwing in the pipes to ample depth to assure a binding, by cementing, by insertion of pins, by lock nuts, locking devices of different patterns, and by using proper judgment in the alignments.

Expanded and Cracked Work.—An experienced man will not, of course, meet with trouble of the description exhibited in Fig. 7, for the reason that he will use precaution in tightening the connections; but it frequently happens that new men make the error of forcing the parts together, and continue the forcing until there is a fracture created, as at *F*, Fig. 7. Of course, the only way to rectify this defect is by the use of a new part. Strange to relate, however, I have seen these types of fractures bound with wire, with a piece of sheet metal inside the wire and against the break.



Wrinkle Department as Read at the Twenty-seventh Annual Meeting, Western Gas Association, St. Louis, Mo., June 14th, 1904.

Edited by MR. W. E. STEINWEDELL.

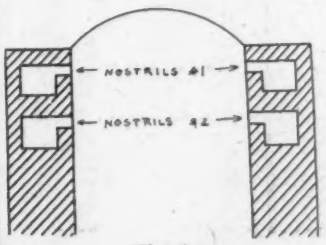


Fig. 1.

No. 1.—*Operating with Choked Gas Nostrils in Benches.*—Mr. G. Falkenstein writes from Cooperstown, N. Y., that he once operated 22 benches of sixes (presumably for the coke) and having a great excess of gas it was first used under boilers and later in benches. Two flues and sets of nostrils were provided, one above the other, as in Fig. 1, and the gas run into one flue for about 6 hours, or until the nostrils were partly choked. The gas was then shifted to the other flue for about 6 hours, and in the meantime the first set of nostrils cleared again. The heats were steady and very even.

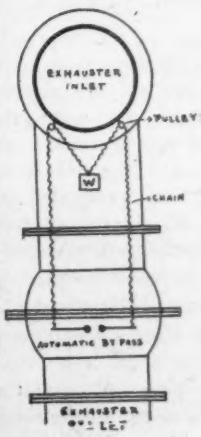


Fig. 2.

No. 2.—*Exhauster By-pass in Vertical Pipe.*—Mr. G. M. Averill has an automatic exhauster by-pass in Cedar Rapids, Ia., located in vertical position, as shown in Fig. No. 2. The weight *W* is slightly greater than that of the 2 "wings" of the butterfly and the valve gives perfect satisfaction.

No. 3.—*Safety Alarm for Relief Holder.*—The blowing of the relief holder involves a loss of gas, and if the exhauster runs after the holder has landed a more serious loss results. Mr. W. E. Hartman, of Joliet, Ills., writes that to prevent either of the above, a steam whistle is connected to the top edge of the relief holder with a long, flexible wire cable, Fig. No. 3. The cable runs between a pair of small pulleys on a block fastened in the middle of one of the holder columns, and a sliding weight is hung on the cable between the

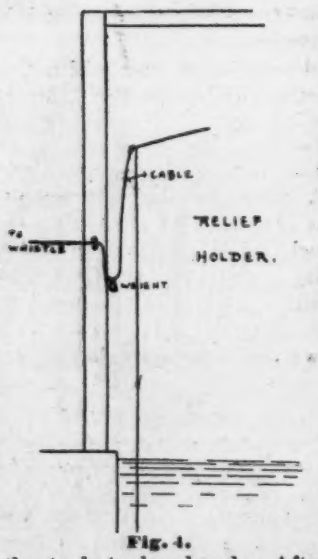


Fig. 4.

pulleys and the holder to take up slack. By adjusting the length of the cable properly it will blow the whistle when the holder is one sheet from blowing or one sheet from landing. The whistle should be blown by hand every noon as a test.

No. 4.—*Method of Excavating Holder Tank.*—Mr. L. L. Kellogg, of Sioux City, Ia., describes the following for a holder tank 96 feet in diameter by 26 feet deep; holder of 425,000 cubic feet capacity. The first 8 feet was a sandy clay. The next 15 feet was a water bearing quicksand, under this was blue clay. The tank is located very close to the electric light plant, and the problem was to excavate without endangering the electrical foundations, as the tank was too close to allow the tank to be sloped. After the first 8 feet had been excavated, the circle of the wall was laid out, and 3 inches by 12 inches by 18 feet sheeting with ends sharpened flat-wise was driven on both sides of the wall around the two circles. The excavating was then continued between the 2 rows of sheeting, and timbers put in to hold the sheeting about 10 feet apart. A concrete footing was put in the blue clay, and as the wall advanced the timbers were removed and the space between the wall and sheeting tamped with earth. Fig. No. 4 shows the

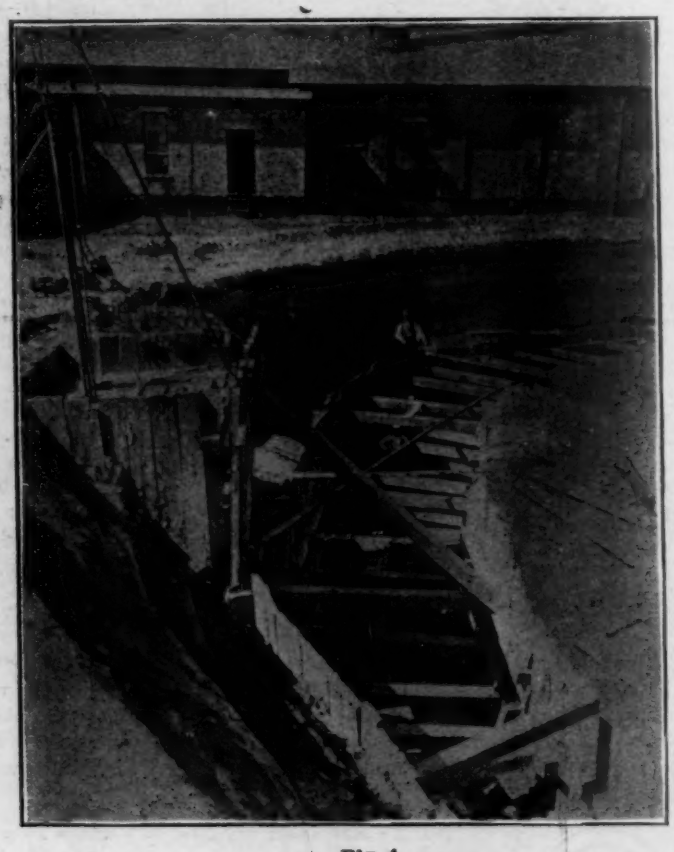


Fig. 4.

sheeting, timbers, tank wall and the earth in the center, which remained until the tank wall was above the top of sheeting. The inside of the tank was excavated by the use of an electric conveyor which dumped behind the wall or into wagons.

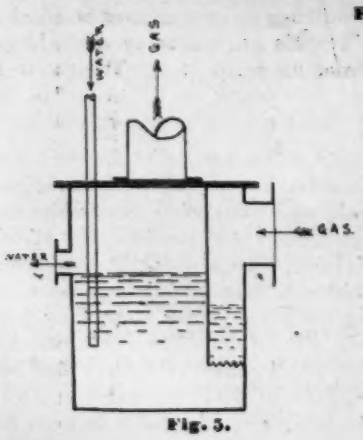


Fig. 5.

No. 5.—*Safety Blow Off.*—In using purifiers with dry lutes there is no large vent for back pressure as is the case when wet lutes are used. A safety blow-off, as shown in Fig. No. 5 should, therefore, be connected with the inlet to the purifiers, so that the seal will blow at slightly less than the seals in the works. Water enters continuously through the pipe from above, and overflows on the side. This waste water can be used in scrubbers or condensers if the pot is placed high enough in the works.

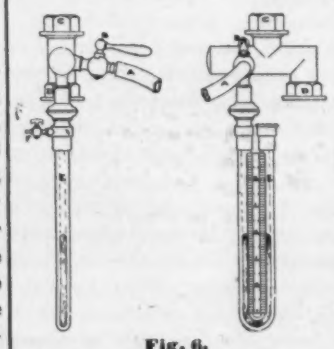


Fig. 6.

No. 6.—*Portable Gauge for Detecting Leaks.*—The accompanying, Fig. No. 6, sent by Mr. Thos. D. Miller, of New Orleans, La., represents a portable mercury gauge which will be found convenient for testing for leaks in meters, piping and fixtures, either in place or in shop, in absence of a pressure holder. Attach the gauge either at *C* or *D*, open the cock *B* and blow in rubber tube *A*. A pressure of 5 inches of mercury can be readily obtained. Closing the cock *B* and observing the gauge the slightest leak will be readily observed. It was designed by the Meter Repair Department of the New Orleans Lighting Company, Lessee.

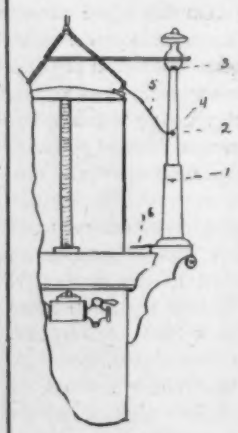


Fig. 7.

No. 7.—*Meter Prover Alarm.*—This device is arranged on a meter prover to give warning when it is time for the operator to make his reading, so that he can be doing other work while the prover is running. Fig. No. 7 shows a cheap and simple arrangement that works satisfactorily. Numbers 1, 2 and 3 are small shelves, made by soldering the small, round tins, that come on the side pipes of a 5-light meter, to a small wire nail. No. 4 is a small weight made from a piece of solder and copper wire; this should not weigh over ¼ ounce so as not to scar the prover. No. 5 is a string 13 inches long, one end made fast to the prover, the other tied to the weight. No. 6 is a piece of tin about 2 inches square, secured by screwing the stanchion down on it. This to act as a sounding plate. On a 5-foot prover the height of the shelves should be about as follows:

No. 1	should be	15½	inches	above	No. 6.
No. 2	"	20¼	"	"	" 6.
No. 3	"	30	"	"	" 6.

If when the prover is full you want to run 5 feet through, say a 10-light meter, put the weight on No. 1 when the scale shows about 4.7 feet run out, the string will put the weight off, it will strike on the tin at No. 6, making a noise that can be heard about 20 feet. Nos. 1, 2 and 3 should be set parallel to the side of the prover nearest the stanchion, so that the string will not catch on the other shelves when using No. 3. —B. F. BULLOCK, Highlandtown, Md.

No. 8.—*Gas Cooking in Public Schools.*—Mr. B. W. Perkins sends the view, shown in Fig. No. 8, of the Department of Domestic Science,

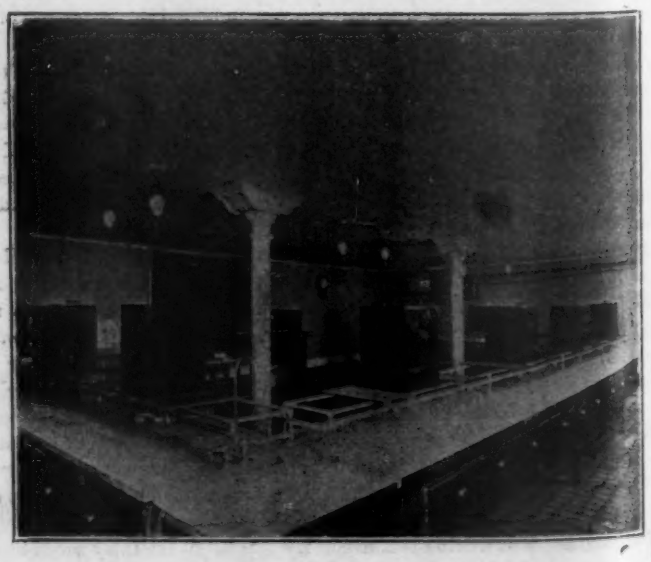


Fig. 8.

in South Bend, Ind. This is studied by the pupils in the eighth grade, each of whom is provided with a perfect equipment for cooking, including a gas hot plate and oven. The teacher has a regular gas range and every convenience is at hand for practical work in this course. It is certain that children thus appreciating the value of gas for fuel, will tell their parents of the gas stove and also "cook with gas" themselves in after years, on account of its efficiency and economy.

No. 9.—*Temperature at Different Depths in Steel Holder Tanks.*—Mr. Geo. H. Waring, of Omaha, Nebraska, writes that ice formed on the side of the tank 13 feet below the surface of the water, which was free from ice. Pint bottles filled with water and corked were hung at different depths for 12 hours. They were then drawn to the surface quickly, one at a time, and the temperature of the contained water found to be within one degree of the temperature of the water in the tank at the depth bottle was hung. Care should be observed that the flange on the curb of the bottom section will not strike the bottles.

The Analytical Valuation of Gas Coals.

[A paper prepared by G. P. LISHMAN, D.Sc., for the June meeting of the English Institution of Mining Engineers.]

A review of the history of the subject shows that there is no generally agreed manner of testing gas coals. The fact is, as was stated in a previous paper submitted by the writer to the Institution, that results from the various forms of laboratory coal testing plant come out most irregularly. This is shown by the results of tests made with one and the same coal, and for the most part on different days, during 1903. The illuminating value per ton of this coal is 580 pounds of sperm; that is, in any well equipped gas works this figure can be obtained from it. The yield of gas varied from 9,650 to 12,400 cubic feet per ton of coal; and the illuminating power from 13 to 18.1 candles. The differences of sperm value extend through the whole range of quality of ordinary gas coals; that is, from 500 to 667 pounds of sperm per ton. The figures show, however, that, even when working with water jacketed condensers (which may be assumed to be very suitable for such a purpose as this) the direct testing of gas coals is useless for comparative purposes, and that any result may be obtained according to circumstances.

The idea, therefore, so frequently found in the literature of the subject (Clegg, Newbigging, Sheard, Wright, and others), that the laboratory apparatus gives results higher than those obtained in the gas works, but comparable to each other, is not borne out by the present investigation. There are many apparent reasons why they should be higher, such as iron retorts, no loss, perfect purification, etc., but they are all overborne by the differences of condensation which occur, the temperature of the apparatus being the main determining factor in the quality of the gas. Mr. Greyson de Schodt, it may be noted, found that laboratory tests were lower than those obtained in the works. The differences in yield of gas are caused largely by differences of retort temperature. When the retort is hottest it may happen that condensers are also hottest; then a large yield is obtained and it is ill-condensed, and, consequently, of higher illuminating power than it would otherwise have been; hence a high sperm value is obtained. Then, again, a new retort makes a difference. A cast iron retort lasts about a month; towards the end of that time the yield of gas has begun to fall off, and, after a week, the difference is sometimes noticeable.

It has been observed that an especially high sperm value is obtained on a warm morning preceded by some days of cold weather; hydrocarbons deposited in the pipes, etc., during the cold days having been picked up again by the gas. And under conditions the reverse of the above, the results are much more lower than the true value of the coal. It is probably for a similar reason that, on the retort becoming hotter during a series of tests and the yield of gas greater, the illuminating power does not always immediately fall; for the gas, far from saturated with benzol, etc., picks up these illuminants on its way to the holder, and the larger the pipes the greater will be this effect. In testing a coal, whenever there has been, between two successive tests, a notable change in the quality of the gas, this effect can be looked for; it explains many an otherwise inexplicable result, and also the frequently observed fact of the comparative uniformity of illuminating power during certain days of testing.

The state of the purifiers also affects the gas.

In a continuous series of tests on a gas coal, no regularity is to be expected from day to day in the results.

These details indicate how essential it is that there should be some check on the indications of an instrument like a coal testing apparatus.

It will be desirable now to give some account of the manner in which the standard coal can be utilized in the valuation of others. It may be said that all extreme results, whether in yield of gas or in sperm value, are rejected as standards of comparison with unknown coals. However many tests may have been made, the results in these cases are rejected and the coal tested again on another day. All the results recorded in the table referred to have been obtained from the standard coal, but several have been rejected as standards of comparison. Although the sperm values in the table are highly variable, they are in nearly every case explicable when one or more of the causes detailed above are taken into consideration, and very often each one was just what might have been expected at the time when it was obtained. Occasionally, unaccountable results will come out, but such are rare. If a series of tests be made from the same coal on any day, the results will, after the first two charges, generally be fairly constant, so long as the apparatus is not allowed to become warm and the retort temperature remains the same. This being so, the testing of an unknown coal is an easy matter. Three tests will probably suffice—namely, (1) unknown coal, (2) standard coal, and (3) unknown coal. The two from the unknown coal being near each other, the mean is taken, and the figure corrected proportionately, according as the standard coal is giving a result higher or lower than its fixed normal value.

Sometimes, however, the case is less simple. It has often been noticed, in a series of tests made during one day and using the same coal, that the sperm values continue to come out higher and higher for each successive test. This is commonly due to the apparatus becoming gradually warmer; and it is hopeless then to operate without a standard. In such a case, at least five tests are required to fix the unknown coal, the second and fourth being made with the standard coal. If a series of sperm values, such as (1) 530, (2) 548, (3) 570, (4) 585, and (5) 605, be obtained, being a rise of about 18 each time, it may safely be inferred that the same figures would have been obtained had the same coal been used in all the tests, and that, therefore, the unknown coal is equal to the standard. The standard coal has a fixed value (in the writer's case) of 580 pounds per ton; therefore the unknown coal is reported as having that value, although under the particular conditions of that day's testing the average result was only 568 pounds. The same result (580 pounds per ton) is obtained by taking the mean of tests (1) and (3), which makes the sperm value 550 pounds; that is on a par with the intervening test from the standard coal, so that the unknown coal would have to be corrected up to the normal value of the standard coal, 580 pounds. But it is necessary to make the five tests in order to be assured that the considerable difference between (1) and (3) is due to a uniform rise in the sperm value and not to some other cause. When the results are rising in this manner, and the unknown coal differs considerably from the standard, the calculation of the unknown coal becomes more complicated and frequently cannot be carried out, and then the coal must be re-tested at a more suitable time. Often, however, the quality can be gauged, as shown by the results here submitted, taken from the writer's note book. In this case, the room was becoming warmer during the whole of the time occupied by the tests. There is a difference of 107 pounds in the sperm value between the first test, taken from the unknown coal, and the last test; and the third test occupies the intermediate position at 546 pounds; there being a rise of about 25 pounds in the sperm value for each test. In order, therefore,

No. of Test.	Sample of Coal.	Yield of Gas Per Ton. Cubic Feet.	Illuminating Power. Candles.	Sperm Value. Pounds.
1	Unknown	10,700	13.5	494
2	Standard*	11,050	14.8	561
3	Unknown	10,400	14.3	546
4	Standard*	10,700	16.4	601
5	Unknown	10,700	16.4	601

*Sperm value, 580 pounds.

to bring all the results to an equal footing 50 pounds must be added to the first test and subtracted from the fifth test, and 25 pounds added to the second test and subtracted from the fourth test. The following series is thus obtained:

Test.	1.	2.	3.	4.	5.
Sperm value, unknown coal	544	..	546	..	551
" standard value	..	586	..	576	..

The sperm value of the standard coal is here seen to be practically at its true fixed value of 580 pounds; therefore, the other coal requires no further correction, and may be taken as having a sperm value of 547 pounds, or 10,500 cubic feet of gas of 15.2-candle power.

It will be seen that considerable judgment is required in the interpretation of the actual results obtained from a coal testing apparatus. This much has been admitted by some operators, but the grounds upon which such judgment is to be based are not often gone into.

In making tests like the above, the last results can nearly always be anticipated before they come out. Over and over again, the same coal has been tested against the standard coal on different days, and while yielding totally different actual results the corrected figures are very much alike.

Sufficient has now been said to give an idea of the somewhat oblique paths by which it is necessary to proceed in order to arrive at the value of a gas coal. No doubt there are many objections to this method—its uncertainty; that is, the possibility of working all day and obtaining nothing; its laboriousness; and its cost, in time and gas, are all against it. Further, a standard coal having a sperm value of 580 pounds is of no use for testing cannel, a separate cannel standard being required for that purpose. Nevertheless, if ever it should be necessary to value gas coals as between buyer and seller, it seems to the writer that, in the present state of knowledge, the only method of avoiding contention would be to adopt a common standard coal obtained from a certain locality. The value of this standard once agreed upon, there would be no need for differences of more than about 15 pounds in the sperm value obtained by different workers. Seams of coal may, of course, vary in quality, and some are well known to do so; but taking the top, the middle and the bottom coal together, many seams with which the writer is acquainted are very constant over areas which may, in certain cases, be measured by miles. It is possible that this divergence of coal seams has been exaggerated, and that differences of results, really due to other causes, may have been put down to variations in the seam.

In the case of a gas company, which, perhaps, has no access to a seam of coal, the best way to obtain a standard coal would probably be to select a colliery, preferably one which supplies gas coal from only one or two seams, and to take the finest hand picked coal obtainable from the wagons from that colliery. To this coal a fixed sperm value of any reasonable figure could arbitrarily be given and utilized as above described. This method would certainly not be so good as always drawing coal from a single definite seam, but as an alternative it would be found of value.

With the increasing use of incandescent burners, illuminating power, as ascertained in the ordinary way, by burning raw gas at an Argand burner, is becoming of less moment, its place being gradually taken by calorific power. Whether, however, the quality of a coal be measured by its sperm value (a function of the yield of gas and the illuminating power) or by another figure (the product of the yield and the calorific power), it seems likely that a standard coal will be required in testing. Experiments to determine this point are being made by the writer.

An English Study of Some American Gas Works.

Some time ago Mr. A. J. Walker, of Leith, Eng., visited America, and on his return he gave to the *Journal of Gas Lighting* the following notes respecting his impressions of some American gas works:

During a visit which I paid to the United States and Canada last year, I saw no signs of gas undertakings being done away with there—in spite of electric lighting. On the contrary, there were rumors in many places of proposed completely new gas works, or at least of great extensions of those already existing; and in some cities—Milwaukee, for instance—the new works were already very much in evidence. The gas managers I had the pleasure of meeting all seemed to be very much interested in the works which were then in progress in this country; and those contemplating the erection of coal gas works or installations were evidently deliberating whether they should introduce horizontal or inclined retorts. On this point, I was sometimes interrogated; but, unfortunately, I could only say then, that while some eminent gas engineers here were busy erecting works containing inclined retorts, others were, in like manner, putting up works with horizontal retorts, and some others, again, equally well known and respected, had been observed pulling down settings of inclined retorts they had already built and tried.

I had always heard that Americans were in the habit of asking strangers a great many questions; but I did not really find this the case. On the contrary, everyone seemed pleased to give information; and I am just a little afraid that I did most of the questioning myself. In three of the cities visited, there were signs of strikes, or threatened strikes, of workmen at the gas works; and I think managers of like undertakings in this country may be thankful that the "walking delegate" cannot swim across the Atlantic.

Connected with some of the undertakings there are splendid offices and show rooms for gas appliances—far superior in appearance to those generally seen here; and the use of gas for cooking and heating is evidently being very much pushed in some places. In connection with one large undertaking, I was informed that there had been the extraordinary increase of 25 per cent. in the consumption of gas in one year through advertising and pushing. Steam, hot water, or hot air, is, of course, almost necessary for heating in some places in the dead of winter; but gas fires in addition are found convenient in private houses, as they can so easily be lit for an hour or two at a time when the weather is not quite so cold. The cookers and gas fires displayed are generally of quite a different type from those in use here—I think less cast iron is used in their construction.

The superintendent of one of the first works I was shown over in Manhattan, when informed of my intention of visiting some of the principal gas works in the eastern part of the United States and Canada, said that I would see a great many things in American gas works which had been tried and found wanting, and which I should take a note of only to avoid, but that I would also see much that might be copied with advantage in the part of the world from which I came. Three months afterwards, when I had seen over about two dozen American works, I considered his prophecy had been sufficiently fulfilled.

In the United States, as is well known, a much greater proportion of carburetted water gas is used than we are accustomed to here; and in all the cities I visited in the States and Canada, except one, I found this kind of gas being manufactured in large quantities, though a proportion of coal gas was generally being made and mixed with it. Judging from what I saw and heard, it seems probable, however, that, in some districts at any rate, the proportion of coal gas manufactured will be considerably increased in the near future.

As the manufacture of carburetted water gas was only seriously taken up in this country after it had been pretty well perfected in America, we have, fortunately perhaps, been spared having all the processes which are still being employed in some of the works there, tried in our works here. In some gas undertakings, two or three of these methods of manufacture were being carried on, at the time of my visit, along with the manufacture of coal gas. In one of these—the Wilkinson—blue water gas, produced in generators of the Tessié du Motay type, is passed into a relief holder, from which it is taken and mixed with naphtha vapor in iron chambers heated by steam. The naphtha drops on sloping shelves or trays, under which there is a system of steam pipes. The mechanical mixture of blue gas and naphtha vapor thus produced is then fixed by passing it through ordinary fireclay retorts, similar to those used in the manufacture of coal gas, about 20 feet long. The heat required for fixing is regulated by passing more or less gas through each retort, and is judged by noting the color of the vapor. By this process, it is said that a very uniform quality of gas, as regards illuminating power, can be produced; but I understand the Wilkinson process is being generally done away with—partly owing to the space occupied by the fixing retorts, and the expense of keeping them heated (there being no coke available for firing in most works), but chiefly, no doubt, because it is becoming difficult, if not impossible, to obtain suitable oil or naphtha.

In another process, which, by some, is considered more economical than the foregoing, and which I heard called the Tessié du Motay process—it is probably a modification of that system—the blue water gas manufactured in similar generators, and passed as before into relief holders, is afterwards enriched with oil gas manufactured in ordinary coal gas retorts about 20 feet long. A tube, about 6 inches in diameter, passes through each of these retorts, which are maintained at a dull red heat. Oil and steam are blown together through these tubes, and the oil vapor thus generated, and issuing from the far end of the tubes, is fixed in passing back through the retorts. White paper or cardboard diagrams, divided into spaces corresponding with the numbers of retorts in each oven (generally six), are used for testing the color of the gas stain at the top of each ascension pipe—a fairly brown stain indicating the right quality of gas. The retorts I saw used for this purpose were heated with waste oil taken from the drips or siphons in the works. The oil is blown into the furnaces with steam or compressed air. In one large works, I found this process was being temporarily introduced in place of Wilkinson's, for which the gas oil being supplied could not be used.

As no oil is allowed to be run into the rivers, all waste oil has to be carefully freed from water, so that it may be utilized. There is generally a large quantity of lampblack and tar in the mixture produced; and it is found that when these are removed the water readily separates from the oil. A good deal of ingenuity is therefore exercised in getting rid of the tar and lampblack—filters or presses of canvass being used for the purpose. The waste oil, when freed from water, is employed in the furnaces before referred to. In a large works in Chicago, I also

saw an example of Pratt and Ryan's apparatus, in which the generator, carburetter and suderheater are combined in one shell.

Of course water gas plant of the Lowe type in various stages of evolution is also common, a very good early example being found in the Canton Station of the Consolidated Gas Company at Baltimore, standing in complete working order as built about 25 years ago. The sets are, or were, comparatively small, and had no separate carburettors; the oil being merely sprayed on the top of the hot fuel at the proper time. The generators and superheaters were built without iron casings; and I was informed that there had been very little outlay on repairs since the works were constructed. This plant was still doing good and economical work.

Nearly all these processes are now, however, quite out of date; and all plant lately put down for the manufacture of carburetted water gas would appear to be similar to what may now be seen in many gas works in this country—except that in most cases it is much more extensive. In some large installations, there are now two generators to each set of carburettor and superheater.

It is worth noting that, in the United States, an American variety of anthracite coal is generally used in the manufacture of water gas, and not coke as in this country. This is not because coal is intrinsically more suitable, but for the simple reason that cheap coke is not available, owing to the small proportion of coal gas manufactured.

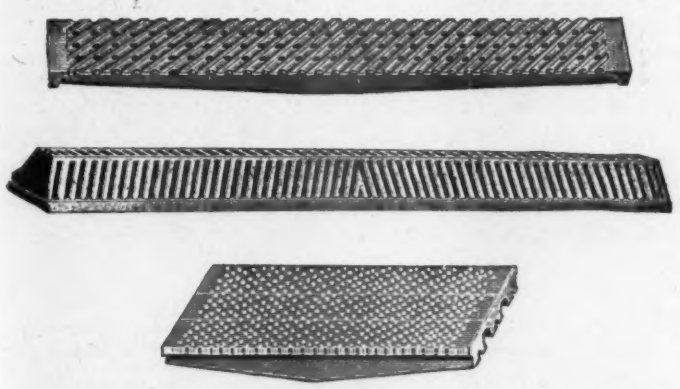
When mentioning coals, I may say that I understand this is usually bought for gas works in the United States by the English (or long) ton of 2,240 pounds, and that gas works statistics there are calculated on this basis, though coal and coke are retailed by the short (or United States) ton of 2,000 pounds.

[Continued from Page 931.]

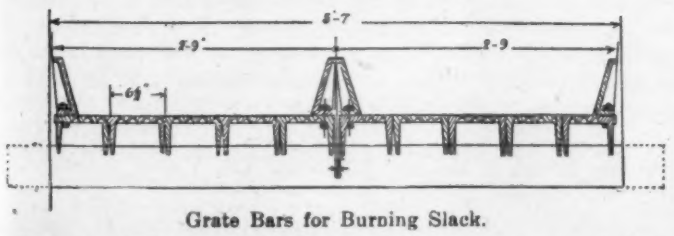
Contents of the Question Box as Read at the Twentieth Annual Meeting, Ohio Gas Light Association, Cleveland, O., March, 1904.

No. 24. "Has anybody tried to burn breeze on the grate bars designed for burning sawdust?"

"The following illustrations show several styles of grate bars de-



Grate Bars for Burning Sawdust.



Grate Bars for Burning Slack.

signed for burning sawdust, also a grate designed" [by a manufacturing concern in Denver.—Eds.]. "The side and center grates of the latter style form a tuyere, which will distribute the air equally around the bed. The grate was originally designed to burn slack and is said to give good satisfaction. The rate of combustion is controlled by the amount of air delivered, and is easily regulated by a valve. The cheapest class of fuel can be used, such as dust, culm, screenings, etc. It will be noted that this grate is very similar in design to some of those used for burning sawdust.—J. C. ANDREWS."

No. 25. "Assume coal contains 1.5 per cent. sulphur and .75 per cent. is left in the coke; the unwashed gas will contain less than the missing amount. Where does the balance of the sulphur go, and is any of it absorbed by the tar. If so, how much?"

"In the various condensations from the plant we find H_2S compounds, CS_2 compounds and CNS compounds, which represent a large proportion of sulphur in the original coal. In the purifying boxes there is a large aggregation of sulphur from various compound, of unknown composition, and we have also found sulphites, hyposulphites ($H_2S_2O_3$), scientifically known as thiosulphates and thionic acids. In the oil obtained from the compression of gas in the Pintsch gas works, compounds of CNS and COS have been found. We have never taken the trouble to work out the percentages in these compounds.—HOWARD E. MANN."

"Sulphur exists in coal tar in many different combinations, such as carbon bisulphide (CS_2), carbon oxysulphide (COS), thiophen (C_4H_4S) and its derivations, etc. The total amount of sulphur in coal tar will vary with the temperature of carbonization and the per cent. of oxygen in the coal, and although even Prof. Lunge gives no analysis of total sulphur in tar, all sulphur that cannot be accounted for in the gas, crude liquor, coke, etc., can safely be estimated as being removed in the tar, for no sulphur or sulphur compounds ever get away.—W. B. CALKINS."

"From a series of determinations made by me in one American works the following results were obtained, representing the distribution of the sulphur of the coal among the products of carbonization. This is fairly typical, but it should be remembered that all the conditions vary from time to time and place to place. The item 'tar' included a certain amount of ammonia water held in suspension:

(1.)

Coal, 2,400 pounds, at 1.09 per cent. S		21 80 lbs.
Coke, 1,400 pounds at .78 per cent. S (weight based on yield for month)	10.92 lbs.	
Crude gas from standpipes (equivalent to 9,640 feet finished gas) at 785 gr. per 100 feet	10.81	
Unaccounted-for	.07	
	21.80	

(2.)

Crude gas from 2,000 pounds coal (at 785 gr. S per 100 feet finished gas)		10.81
Tar, 131 pounds, at .76 per cent. S (weight based on yield for month; S. based on tar in wells at time of gas test)	1.00	
Am. liquor, 427 pounds at 20 per cent. S (figures on same basis as tar	.85	
S left in boxes, based on shipments for year	8.00—	
Purified gas, 9,640 feet at 32 grams S per 100 feet	.44	
Unaccounted-for	.52+	
	10.81	

—H. B. HARROP."

No. 26. "How much water is required per 1,000 cubic feet for the manufacture of coal gas for all purposes, including boiler feed water, scrubber, washer, etc.?"

"All of the water which we use at our gas works is metered, and we pay for the amount of water used as shown by the meter. This amount includes all of the water used for all purposes. such as boiler feed, scrubber, seals, holder tank, coke, etc. Taking the gas made for the last 2 years and the amount of water used, as shown by meter, we use an average of 97.5 gallons of water per 1,000 cubic feet of gas made.—F. C. WEBBER."

"It depends entirely on the economy practiced round a works. We utilize rain water, conduct it to the boiler room and use it there. In December we made 5,689,000 cubic feet of coal gas, and used a little over 600,000 gallons of water.—W. A. ALDRICH."

"The average of 2 gas works, one of which makes 20 millon feet, and the other 24 million feet per year, was from 30 to 40 gallons of water used per 1,000 cubic feet of gas made. The amount used depended on the amount of air condensing surface available, the amount of water used for the scrubber, and the size of the holder pits it was necessary to keep warm in the winter time.—F. W. STONE."

No. 27. "Are wet lime purifiers in use at all in modern practice?"

"Lime is not used in solution, the disposal of the foul liquid being difficult.—W. E. BROWN."

No. 28. "Are there any gas companies using ammonia for sulphur purification beyond the amount of sulphur incidentally picked up in the scrubbers, and if so, what is the process and how much of the sulphur is removed?"

"References: Claus' Process, 'Newbiggings' Handbook,' page 113.—PAUL DOTY."

No. 29. "How much CS_2 can be removed from the gas without the use of lime, and what is the best method of securing this result?"

"The following article is taken from the *Journal of Gas Lighting*, Aug. 11, 1903: 'Freeing Gases from Carbon Dioxide.—Tohl. A., of Hoenningen-on-the-Rhine, Germany.—No. 13,466; June 16th, 1903.—In the ordinary scrubbing processes employed in gas works, illuminating or heating gas is, the patentee points out, freed from sulphureted hydrogen; but the gas obtained is not free from sulphur. The sulphur constituent of the purified gas is caused by the presence of carbon di-

sulphide, which cannot be removed by known purifying processes. But a means has been discovered, he says, for freeing gases of all kinds from carbon disulphide vapor, consisting in submitting the gas—either before or after it undergoes the ordinary purifying process to which it is submitted in gas works for removing the various impurities—to a further washing with a washing medium which completely absorbs the carbon disulphide; any convenient form of scrubber being employed for this purpose. The substance 'which produces this result of completely absorbing the carbon disulphide from gas, without detrimentally affecting either its illuminating or heating properties,' is the oily constituent of the products resulting from the distillation of vinasse. This oil is obtained, together with an aqueous solution when vinasse (that is to say, the residual liquid which remains when sugar is removed from beet sugar molasses by fermentation or by any desaccharifying process—for instance, by means of barium oxide, strontium oxide, or calcium oxide) is submitted to distillation. The vinasse is heated for obtaining the oil, so that dry distillation is effected. The distillation may take place, for example, over an open fire in retorts; and the distillation products are condensed and collected. An oil and an aqueous liquid are obtained, which are separated by pouring off the oil floating on the water. The oil, when dried, presents the property of absorbing large quantities of disulphide; and by heating, either with or without simultaneous introduction of steam, the oil, previously used, may be again rendered suitable for absorbing carbon disulphide from gas. The above appears in the Register of Patents.—K. M. MITCHELL."

"This subject has had my attention for the past 10 years. I have tried every method mentioned in the patent literature of the United States, Great Britain and Germany. Some of the processes do the work but partially, and all of them are too expensive to be considered from a practical standpoint when compared with the lime method. I have, however, succeeded in developing a process which avoids the objections above mentioned, and I expect shortly to be able to bring this matter before the gas fraternity.—CLARENCE S. LOMAX."

No. 30. "What is the best and quickest method for determining how long to keep a foul box of oxide of iron in service?"

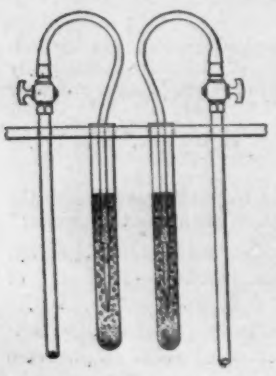
"By the way it revivifies.—HOWARD E. MANN."

"Oxide at best is uncertain material. It is variable, capricious, unsteady and inconstant. The proportion of free sulphur mingled with the mass is not a true criterion of its usefulness, and in fact I don't know what is. The best way I know of is—when it won't work any more, and you can't revive it, throw it away.—B. E. CHOLLAR."

Mr. C. A. Luther remarks that by using a certain apparatus known as the Tutwiller Apparatus, No. 9,381, a test can be made in a very few minutes of the amount of sulphur entering and leaving the first box, which will show the amount of sulphur removed and whether or not it is economical to continue the foul box in use.

"When there are sufficient numbers of purifiers and the condensation and purification capacity is ample, the oxide box need not be changed as long as it will permit gas to pass through it. By the admission of 2 per cent. of air, I have let a box of oxide remain in use 3 years, and only changed then because of oxide becoming hard; therefore, as long as the first oxide box does not show excessive back pressure, it should not be changed, unless the second box becomes foul and the admission of air fails to prevent the removal of H_2S in second box. —JAMES W. DUNBAR."

"I take it this refers to plants using two or three purifying boxes. We get a line on time by actual test, keeping a record. Sometimes back pressure will spoil one's calculations, forcing one to take off box sooner than record would indicate.—E. M. OSBOURNE."



"The illustration shows an easy method of determining whether the bed of oxide is doing service or not. Mr. B. E. Chollar describes the arrangement as follows: It frequently happens that both the inlet and outlet of a purifying bed will show an equally foul test with lead paper while the bed may yet be doing work. The above shows how this condition may be ascertained; a pipe and stopcock leading from each side of the bed, rubber tubes with glass nozzles of equal size attached, and a weak solution of permanganate of potash are all that are required. Put equal quantities of equal strength of the solution in the test tubes, insert the glass tubes and turn on the gas in both at the same time. Foul gas will make the solution clear almost immediately. If the bed is doing work the inlet side will clear up quicker than the outlet side. Two or 3 grains, or perhaps less, of permanganate to the quart of clean water are sufficient. Keep the solution in a well-stoppered bottle, and don't make up too much at a time. The above is taken from the 'All American Gas Wrinkles,' published in the Western Gas Association Proceedings, May, 1903, page 98. My opinion is, judging from the few experiments that we have been able to make, that, when the outlet of a box clears up in about 4 to 5 times the length of time it requires the inlet to clear up by this method, it is time to change the box, as it would be taking out less than 30 per cent. of the sulphur in the gas.—O. O. THWING."

No. 31. "What labor-saving machinery can be advantageously used in a works manufacturing about 200,000 cubic feet of coal gas per day?"

"For a works making about 200,000 cubic feet of coal gas, the inclined system of retorts, with a wheelbarrow charging arrangement, together with a good, satisfactory half depth regenerative furnace for the benches, and a '*superintendent who knows how*,' would be at all times the best labor saving-device. But supposing the inclines cannot be installed for any reason (as for instance, that the retort benches there already are good, or the expense to change would be too high), then I recommend a charging and drawing device which is a German invention, and actually seems better than several more pretentious stoking machines, and which is highly recommended to me by men in whom I have confidence. The cost of this machine is quite moderate; it can be placed in any existing retort house, and is worthy of being looked up by those who wish to improve.—FREDERIC EGNER."

"Where there is no stoking machinery, a scoop 8 feet 6 inches long, 11 inches wide and 7 inches deep, with a tee handle made of ¾-inch rod iron firmly braced to the end of the scoop for charging, saves labor, time and gas; 2 are required for each bench. On the scoop being filled (it holds about 175 pounds) with coal, one man takes hold of the handle, raises it, and another places a semi-circular bar under it; a third man takes the other handle; it is then raised into the mouth of the retort; the end man pushes it in, turns it over and pulls it out again, the man catching the scoop on the 'horse' This is repeated a second time with the other scoop, reversing the order of turning. A hopper for firing hot coke is also a great labor saver; a large hopper with a nose-piece fitting the firebox door and suspended overhead with a wire cable, which runs along and over the top of the benches. The coke is drawn from the retort, is caught in the hopper and pushed into the furnace. When not in use, the hopper may be drawn away from the bench.—W. A. ALDRICH."

No. 32. "Is any CS_2 removed with the ammoniacal liquor in the scrubber or the ammonium sulphur compounds which are formed, and if so, what is the nature of the chemical combination?"

"Believe that the action of NH_3 on the CS_2 is to form ammonia sulphocyanide and ammonium sulphide by first forming the sulphocyanic acid according to the empirical formula $CS_2 + NH_3 = HCNS + H_2S$. The addition of the excess of NH_3 to this reaction will give the ammonia salts of each of these acids.—HOWALD E. MANN."

"In all probability ammonium sulphocyanate ($CNSNH_4$) is formed by carbon bisulphide and free ammonia. $CS_2 + 4NH_3 = CNSNH_4 + (NH_4)_2S$.—J. A. SHAEFFER."

"It is probable that some CS_2 is taken out in the form of ammonium thiocarbonate $(NH_4)_2CS_3$. $(NH_4)_2S + CS_2 = (NH_4)_2CS_3$.—DONALD DAVIDSON."

"$CS_2 + 4NH_3 = NH_4CNS + (NH_4)_2S$—this happens. It is also asserted that CS_2 combines with normal ammonium sulphide to form thiocarbonate; $CS_2 + (NH_4)_2S = (NH_4)_2CS_3$. Besides these, there are several doubtful reactions to be found in the books.—H. B. HARROP."

[To be Continued.]

The Mechanical Stoker and the Human Operator.

By MR. EDWIN YAWGER.

The mechanical stoker is an accessory to an art, and the man who operates the stoker is an accessory to the same art. The mechanical stoker is not a thing by itself. It will not in any way alter the fundamental principles of the combustion of fuel. It is a part of a system, of which the air and gas passages, the baffles and the stack, as well as the operator, are correlative parts. Rankine, in his manual of the steam engine, enumerates 17 parts and appendages that go to make up a boiler furnace. His definition covers practically every part of a boiler equipment, except the vessel that contains the water and steam, and no build-

er of stokers should assume to offer his machine to a customer unless he is competent to submit a complete furnace design, properly calculated for the conditions of a particular case. Probably more failures have been due to neglect of this requirement than to inherent faults of stokers as machines.

It is evident from the broader view of the appurtenances of a furnace that the mechanical stoker is to be studied, not as a piece of machinery, but as an accessory in the art of fuel combustion.

The size of the plant, the kind of fuel available, the type of boiler to be used, the preliminary handling of fuel, the conditions of service, the design of all parts of a furnace, and the character of the operator. These are vital problems in the art, and a happy solution of all of them would greatly reduce the mortality record of the mechanical stoker.

Much of the literature on stokers and on combustion in general consists of records of various performances, in which, as a rule, some one feature is prominent and others more or less ignored. A vast majority of boiler trials are utterly unreliable, and even the most reliable contribute little assistance to commercial judgment.

Mr. Bryan Donkin, in his book, "Heat Efficiency of Steam Boilers," gives a careful analysis of 425 boiler trials. His conclusion from this array of data is best given in his own words:

"When making these summaries, the author at first thought he might be able to draw from them the conclusion that some one type would prove to be more economical than another.

"It is quite clear that much more depends upon how a given boiler, of whatever type, is worked, with clean or dirty surfaces, good or bad combustion, etc., than upon its form, internal or external fires, water or smoke tubes, or the particular way the differently shaped heating surfaces are presented to the furnace and hot gases."

When 400 trials, carefully selected and analyzed, fail to produce any general law, it is evident that another point of view is necessary for broad and practical conclusions.

Leaving out, then, the question of detailed tests, it will be the object of this paper to present some of the general considerations that bear on the art of combustion of fuel in boiler furnaces.

The mechanical stoker, as a machine, must possess many points of excellence in order to contribute fully to net commercial economy. First and foremost, it must be so designed that it will continue to supply heat to the boilers in spite of accidents or unfavorable conditions of fuel and service. If heavy clinkers form they should be capable of easy disposal. If the actuating mechanism fails, it should be possible to continue firing by hand manipulation. If grates break it should be possible to replace them without drawing the fire. In addition to these primary requirements are the numerous details that must be worked out in all their relations before the full measure of fuel and labor economy can be realized.

I believe that next to the matter of continuous operation, the most important feature of furnace design lies in the handling of the air for combustion, A noticeable thing about records of boiler trials is the general lack of uniformity of results under apparently similar conditions. Unfortunately, the factor that enters most largely into this variation is seldom recorded, namely, the relative amount of air consumed. In furnace combustion the fact is often ignored that air is a fluid with a definite specific gravity and a consequent inertia.

No one would expect water mains to be efficient if constructed with a diversified cross section, sharp turns and odd corners. Yet it is common to build furnaces in which the gases meet with improper deflection, unnecessary obstruction and restricted passages. Sometimes the ashpit and its doors are arranged in such manner that the air by its inertia seeks passage through a restricted area of the fire, usually the rear.

I have in mind one case where a hopper bottom ashpit being open at the front furnished the principal channel for incoming air, which was directed against the rear of the fire, thus causing airholes and a reduction in capacity and efficiency. In some cases a great loss in draft efficiency is caused by the clashing of burnt gases as they issue from various boilers into the smoke connection. I know of a case where two boilers were fitted with a vertical uptake, extending over both boilers. An increase of 25 per cent. in the efficiency of the draft was accomplished by placing a partition in the uptake, to separate the gases issuing from adjoining boilers.

It is a matter of common observation that there is frequently a considerable variation in draft in different furnaces where a number are connected to the same stack.

When the furnace is hand-fired, all the losses due to the improper manipulation of the air supply are rendered much greater, An indication of this can be obtained by noting by means of a gauge the variation of draft in the fire chamber during a cycle of firing.

I believe it is the practice of boiler manufacturers to establish a fixed arrangement of baffles. The furnace specialist goes further than this, and arranges the baffles to conform to the nature of the service and the amount of draft in the particular case.

Accessibility is a prime requisite, and that stoker will give the best service in which the condition of the fire can be seen, and obstructing clinkers dislodged without the opening of doors.

In view of the prevailing tendency toward the use of large boilers, stoker design must permit of a corresponding expansion of grate surface. In many cases 500-horse power or 600-horse power boilers, instead of being fitted with the proper amount of grate area, as determined by the draft and weight of coal to be burned, are expected to give results on a restricted grate, simply because the design does not permit the proper area.

The data at hand on the question of durability offer, if possible, a wider range than above indicated for boiler trials in general.

The peculiar thing about reports of stoker repairs is that records cover only the two extremes of experience. In a few plants the small cost of repairs being a matter of pride, a segregated record is kept of stoker repairs. In other plants, more unfortunate in design and operation, excessive repairs are often reported. The range in this respect varies from ½ a cent or less per ton of coal fired to 12 cents in extraordinary cases. In the large majority of plants between these extremes there is no record available.

It should be noted that the life of a boiler and a furnace should be logically reckoned, not by the year, but by the gallons of water evaporated and the number of tons of coal consumed.

The foregoing requirements are generally understood and accepted.

Other questions of furnace design no doubt have two sides, with advocates for each. A number of makers construct furnaces calculated to reject the refuse continuously and automatically, the argument being that this reduces the labor required and adds to the effectiveness of the operation. On the other hand, it is claimed that continuous discharge will carry over a considerable amount of combustible when fires are forced, while with light firing there will be a thin zone in the fire near the discharge point that will admit an excess of air; also that large clinkers will occasionally fail to pass through an otherwise automatic discharge.

The extent of the firebrick arch over the fire in furnaces operating with progressive feed is sometimes subject to discussion. The presence of an arch sufficient to reflect heat on the fuel until it is well coked is always recommended. It is argued, however, that the external fire chamber, with its full-length arch, throws back all of the radiant heat upon the fire, thereby increasing the rapidity of combustion and insuring its completeness. Other authorities state that it is better to expose the heating surface promptly to the highest possible temperature, to this end making use of a large proportion of direct radiation. Rankine states that about one-half of the total heat from the combustion of coal is given up in radiation. The open fire, therefore, would project a greater quantity of heat against the first row of tubes, with a tendency to intensify evaporation at that point. Experiments made by the Northern Railway Company of France showed that evaporation around the fire-box of a locomotive boiler averaged seven times as great per square foot of heating surface as the rate in the flues.

There is no increased danger to boiler tubes by reason of high temperatures. The rupture of a tube is invariably due to some cause within itself, either a flaw in material or the presence of scale sufficient to interfere with the releasing of steam. With these facts in mind, and with a view to reduce as far as possible the loss by external radiation and air leakage, it seems the logical thing to design an arch deep enough to insure the absence of combustible gases in the flues, at the same time permitting a liberal amount of direct radiation.

Judging from the number of 60-foot stacks in use, especially in steel works, there would appear to be a wide diversion of opinion on the subject of draft. If I were asked to specify a single improvement in furnaces that would net a greater saving than any other, the reply would be "double the height of all the stacks now in use." Intensified draft will work wonders.

1. It will permit the burning of more coal per square foot of grate, thereby increasing furnace temperature. The burning of more fuel per square foot of grate service, and the consequent high temperature, is in itself an element of economy, illustrating one of the fundamental laws of thermodynamics, which states that efficiency is dependent on the range of temperature in the working medium.

2. It will make combustion complete at a point nearer the coal; that is, the flame will be shorter and the excess of air will be less. This condition is due to the fact that a strong draft rushes among the fuel at high velocity, causing a more intimate mixture of air with the inflammable gases.

3. The same volume of gas at the same temperature will give up

more of its heat when passed rapidly than when passed slowly over the same heating area. Many experiments have been made to determine a law governing the effect of speed on the liberation of heat from gases, but the results are variable. All agree, however, that the effect is important.

It is plain from this that the stack or draft apparatus has a function not usually accorded to it, namely, that of overcoming friction in gas passages induced by high speed of gases. It is considered by many a point of good management to reduce as much as possible the internal friction in furnaces, but if this is done at the expense of speed of gases, the result will be a reduced capacity and a higher stack temperature.

Lack of space forbids taking up other points that are quite well known but often overlooked. For instance, that soot is more fatal to economy than is scale, but not so fatal to boilers, and that under no circumstances does water do duty as fuel.

It is common experience that no part of a power plant is subject to so much neglect as are the boilers. The reason for this lies in two inevitable weaknesses of human nature.

1. A reluctance to perform a dirty and disagreeable task.
2. A reluctance to perform any task when its results are not apparent to the observation.

An engine operator may build up a reputation by giving such attention to his engines that they will not offend the eye or the ear of the observer. The chances are that if his engine looks clean and runs quietly, it is in fact in good order; but the external cleanliness of a boiler would argue little as to the absence of scaled tubes, soot choked passages or broken down baffles.

Some years ago I became partly responsible for the operation of a large mechanically fired plant in Pittsburg. There were 16 boilers in the plant, and I was asked to determine why it seemed impossible to secure steam for the engines. I made a brief examination of the boilers, and found that the stack draft in the different batteries ranged from .45 inch to .7 inch of water, and that stack temperatures varied from 450° to above 700°. The general condition inside the furnaces seems obvious. I agreed with the management to pick out a man who would enter their employ and have full charge of the boiler plant, with the expectation that a change would soon be apparent. An inspection by this man showed that in some cases soot had accumulated in such quantities as to choke the gas passages. This explained the low draft and temperature in some of the stacks. In other cases the baffles were broken down and displaced to such an extent that the gases made practically one pass through the tubes and escaped at high temperature. This gave the key to the other extreme stack condition. It was found, by a little close observation, that the attendants reported the external cleaning of the tubes without going through the formality of doing the work. A short period of personal supervision served to put the plant in such condition that steam was easily supplied by 14 boilers instead of 16. This happened in a stoker fired plant; it would have been worse in a hand fired one, because the same human nature would have been there, only more of it. It is evident that such delinquencies on the part of attendants work equally disastrous results, whether the plant is stoked by hand or by machine.

There is another phase of human nature that has an important bearing on the comparison of hand versus machine firing which probably furnishes the stoker manufacturer with his strongest argument in favor of the superior fuel economy of the mechanical stoker. It is the well-known fact that there is a wide variation in the efficiency of individual firemen in the actual manipulation of the fires. I am told by the superintendent of motive power of one of our greatest railroads that his company has for a long time maintained a system of rewards, based on the economy in coal obtained by the different locomotive firemen. Basing observations upon the records of a large number of firemen, who have been under the system long enough to establish a personal average, it is found that certain individuals maintain a higher average of rewards than others throughout a long period of service. If, therefore, the company could secure a force of firemen, each one of whom could equal the best average, there would be a saving in fuel amounting to many times the sum required for premiums.

One universal result of the substitution of mechanical for manual methods consists in a greater uniformity of product, and from the nature of the operation it is possible to maintain a stoker at or near its highest efficiency. To obtain this very desirable condition it will be necessary to start right by making a competent engineer responsible, not only for the selection of the machine, but for the unity of design of the entire furnace from ashpit to top of chimney.

To maintain a boiler plant at its highest efficiency is not a complex problem, but enough has been said to show that it requires constant and intelligent supervision. It is its capability of responding to intelligent supervision that renders mechanical stoking superior to the human kind. The functions of the machine are varied, when necessary, by positive adjustments, and changes in adjustments can be governed by definite rules easily within the comprehension of the dullest operator. I should say in general that any chief engineer of a station, who himself is capable of operating successfully a mechanical furnace, can, with a reasonable amount of attention, secure uniformly good results throughout a large plant.

Recording instruments of various kinds will be found useful, especially in mechanically fired plants. Probably the most useful record obtainable in connection with furnace operation is a record of the amount of air supplied. With the uniform conditions due to mechanical stoking, such a record gives a fair indication of the degree of efficiency of the furnace. This record is obtained in many plants by an apparatus for the continuous analysis of flue gases. The use of a draft gauge, attached permanently and showing the draft in the fire chamber, will give an approximate idea of the amount of air consumed. A diminution in draft at this point indicates air holes and an excess of air, while a great increase will indicate too great a thickness of fire and a probable presence of CO in the flue.

It will be noticed that an expert stoker fireman, in running a test, will keep his fire gauge at that point which indicates the proper thickness of fire.

A proper appreciation of any art is obtained by a study of its masterpieces, and an engineer who has full knowledge of all that contributes to the success of the best actual installation will be best able to duplicate that success in other situations.

Lutes.

[A paper read by Mr. Samuel S. Sadtler, Chem. Section, Franklin Institute.]

The subject of plastic cements used to secure joints in vessels and connections (generally for temporary purposes), has been rather neglected in the chemical literature.

The success or failure of processes has very seldom depended upon the choice of satisfactory lutes, but great annoyance has been experienced in chemical works and manufacturing places where only unsuitable compounds have been found to seal apertures in nitric acid, chlorine, hydrogen sulphide and illuminating gas apparatus, and frequently considerable damage to property and loss of life has resulted.

I have, therefore, thought it advisable to bring together under one title such formulæ as I know to be reliable, or have reasonable grounds for believing so, and hope they may be useful to others for laboratory or works' use.

The majority of these cements are useful for purposes of preventing the escape of inert gases, and others are suitable for more or less special purposes, where corrosive gas, etc., comes in contact with them. Many of them had to be put down from memory, and therefore the product obtained in their use may be a little too stiff or too thin, but such deficiences could be easily regulated.

Lutes always consist of a menstruum and dissolved or suspended solids, and they must not be attacked by the gases and liquids coming in contact with them. In some cases the constituents of the lute react to form a more strongly adhering mass.

The *conditions of application* are, in brief:

(*a*) Heating the composition to make it plastic until firmly fixed in place.
(*b*) Heating the surfaces.
(*c*) Applying the lute with water or a volatile solvent, which is allowed to volatilize.
(*d*) Moistening the surfaces with water, oil, etc. (the menstruum of the lute itself).
(*e*) Applying the lute in workable condition and the setting taking place by chemical reactions.
(*f*) Setting by hydration.
(*g*) Setting by oxidation.

These principles will be found to cover nearly all cases.

Joints should not be ill fitting, depending upon the lute to do what the pipes or other parts of the apparatus should do. In most cases one part of the fitting should overlap the other so as to make a small amount of the lute effective and to keep the parts of the apparatus rigid, as a luted joint is not supposed to be a particularly strong one, but rather one quickly applied, effective while in place and easily removed.

Very moderate amounts of the lute should be used, as large amounts are likely to develop cracks, be rubbed off, etc.

A classification may be given as follows:

(1) Plaster of Paris.
(2) Hydraulic cement.
(3) Clay.
(4) Lime.
(5) Asphalt and pitch.
(6) Resin.
(7) Rubber.
(8) Linseed oil.
(9) Casein and albumen.
(10) Silicates of soda and oxychloride cements.
(11) Flour and starch.
(12) Miscellaneous, including core compounds.

I. *Plaster of Paris* is, of course, often used alone as a paste, which quickly solidifies, for gas and wood distillation retorts, etc., and similar places where quickness of setting is requisite. It is more often, however, used with some fibrous material to give it greater strength. Asbestos is the most commonly used material of these, as it will stand a high temperature. When this is not so important, straw, plush trimmings, hair, etc., are used as binders, while broken stone, glass, and various mineral substances are used as fillers, but they do not add anything to the strength. These lutes seem to be particularly suitable for oil vapors and hydrocarbon gases.

Formulæ: (1) Plaster and water; (2) plaster (wet) and asbestos; (3) plaster (wet) and straw; (4) plaster (wet) and plush trimmings; (5) plaster (wet) and hair; (6) plaster (wet) broken stone, etc.

II. *Hydraulic Cement.*—Cement is used either alone or with sand, asbestos, etc., and I have been informed that these lutes are suitable for nitric acid. When used with substances such as resin or sulphur, it is probably employed because it is in such a fine state of division and used as a filler and not because of any powers of setting by hydration.

Formulæ: (1) Cement—neat; (2) cement and asbestos; (3) cement and sand.

III. *Clay.*—This most frequently enters into the composition of lutes as a filler, but even then the very finely divided condition of certain grades renders it valuable, as it gives body to a liquid, such as linseed oil, which, unless stiffened, would be pervious to a gas, the clay in all cases being neutral. Thus, for luting pipes carrying chlorine, a stiff paste of clay and molasses has been suggested by Theo. Köller in *Die Surrogate*, but I cannot recommend it, as it soon gives way.

Formulæ: (1) Clay and linseed oil; (2) same using fireclay; (3) clay and molasses. (1) Is suitable for steam, etc.; (2) for chlorine and (3) for oil vapors.

IV. *Lime* is used in the old lute known as putty, which consists of caustic lime and linseed oil. Frequently the lime is replaced by chalk and china clay, but the lime should be, in part at least, caustic, so as to form a certain amount of lime soap. Lime is also used in silicate and casein compositions, which are very strong and useful, but will be described elsewhere.

Formulæ: (1) Lime and boiled oil to stiff mass; (2) clay, etc., boiled oil to stiff mass.

V. *Asphalt and Pitch.*—These substances are used in lutes somewhat interchangeably. As a rule, pitch makes the stronger lutes. Tar is sometimes used, but, because of the light oils and, frequently, water contained, it is not as good as either of the others.

Asphalt dissolved in benzol is very useful for uniting glass for photographic, microscopical and other uses. Also for coating wood, concrete, etc., where the melted asphalt would be too thick to cover well. Benzol is the cheapest solvent that is satisfactory for this purpose, as the only one that is cheaper would be a petroleum naphtha, and it does not dissolve all the constituents of the asphalt. For waterproofing wood, brick, concrete, etc., melted asphalt alone is much used, but when a little paraffine is added it improves its waterproofing qualities, and in particular cases boiled oil is also added to advantage.

Formulæ: (1) Refined lake asphalt; (2) asphalt, 4 parts; paraffine, 1 part; (3) asphalt, 10 parts; paraffine, 2 parts; boiled oil, 1 part.

Any of these may be thinned with hot benzol or toluol. Toluol is less volatile than benzol and about as cheap, if not cheaper, the straw colored grades being about 24 cents per gallon.

Examples of so called "Stone Cement" are: (4) Pitch, 8 parts; resin, 6 parts; wax, 1 part; plaster, ½ to ¼ part; (5) pitch, 8 parts; resin, 7 parts; sulphur, 2 parts; stone powder, 1 part.

These compositions are used to unite slate slabs and stoneware for domestic, engineering and chemical purposes. Various resin and pitch mixtures are used for these purposes and the proportions of these two ingredients are determined by the consistency desired. Sulphur and stone powder are added to prevent the formation cracks. Sulphur acting chemically and stone powder mechanically. Where the lute would come in contact with acid or vapors of the same, limestone should not be the powder used, otherwise it is about the best. Wax is a useful ingredient to keep the composition from getting brittle with age.

A class of lutes under this general grouping that are much used are so-called "Marine Glues." They must be tough and elastic. When used for caulking on a vessel they must expand and contract with the temperature and not crack or come loose.

Formulæ: (6) Pitch, 3 parts; shellac, 2 parts; pure crude rubber, 1 part. (7) Pitch, 1 part; shellac, 1 part; rubber substitute, 1 part.

These are used by melting over a burner.

VI. *Resin, Shellac and Wax.*—A strong cement used as a stone cement is: (1) Resin, 8 parts; wax, 1 part; turpentine, 1 part.

It has little or no body and is used in thin layers.

For nitric and hydrochlorine acid vapors: (2) Resin, 1 part; sulphur, 1 part; fire clay, 2 parts.

Sulphur gives great hardness and permanency to resin lutes, but this composition is somewhat brittle.

Good waterproof lutes of this class are: (3) Resin, 1 part; wax, 1 part; powdered stone, 2 parts. (4) Shellac, 5 parts; wax, 1 part; turpentine, 1 part; chalk, etc., 8 to 10 parts.

For a soft air tight paste for *ground glass surfaces:* (5) Wax, 1 part; vaseline, 1 part.

(6) A strong cement, without body, for *metals* (other than copper or alloys of same), *porcelain* and *glass* is made by letting 1 part of finely powdered shellac stand with 10 parts of ammonia water until solution is effected.

VII. *Rubber.*—Because of its toughness, elasticity and resistance to alterative influences, rubber is a very useful constituent in lutes, but its price makes its use very limited.

Leather cement: (1) Asphalt, 1 part; resin, 1 part; gutta percha, 4 parts; carbon disulphide, 20 parts.

To stand acid vapors: (2) Rubber, 1 part; linseed oil, 2 parts; fire clay, 3 parts.

Cement for mending rubber: (3) Rubber crude (sliced), 1 part; resin, ½ part; clay, 8 parts.

(4) *Plain Rubber Cement.*—Cut the crude rubber in small pieces and then add the solvent. Carbon di-sulphidē is the best, benzol good and much cheaper, but gasoline is probably most extensively used because of its cheapness.

(5) To make corks and wood impervious to steam and water, soak them in a rubber solution as above; if it is desired to protect them from oil vapors, use glue composition. (See Section IX.)

VIII. *Linseed Oil.*—This is one of the most generally useful substances we have for luting purposes, if absorbed by a porous substance that is inert.

Formulæ; (1) China clay, linseed oil, of general utility for aqueous vapor; (2) lime, linseed oil, forming the well-known putty; (3) red or white lead and linseed oil.

These mixtures become very strong when set and are best diluted with powdered glass, clay or graphite. There are almost an endless number of lutes using metallic oxides and linseed oil. A very good one, not getting as hard as those containing lead, is: (4) Oxide of iron and linseed oil.

IX. *Casein, Albumen and Glue.*—These if properly made become very tough and tenacious; they stand moderate heat and oil vapors, but not acid vapors.

(1) Finely powdered casein, 12 parts; slaked lime (fresh), 50 parts; fine sand, 50 parts; water to thick mush.

A very strong cement for ground unions, stands moderate heat, as follows: (2) Casein in very fine powder, 1 part; rubbed up with silicate of soda, 3 parts.

A strong lute for general purposes, which must be used promptly when made: (3) White of egg made into a paste with slaked lime.

A composition for soaking corks, wood, packing, etc., to render them impervious to oil vapors, is: Gelatin or good glue, 2 parts; glycerine, ½ to 1 part; water, 6 parts; oil of wintergreen, etc., to keep from spoiling.

X. *Silicate and Oxy-Chloride Cements.*—For oil vapors, standing the highest heat: (1) A stiff paste of silicate of soda and asbestos.

Gaskets for superheated steam, retorts, furnaces, etc.: (2) Silicate of soda and powdered glass, dry the mixture and heat.

Not as strong, however, as the following: (3) Silicate of soda, 50 parts; asbestos, 15 parts; slaked lime, 10 parts.

Metal cement: (4) Silicate of soda, 1 part; oxides of metal, such as zinc oxide; litharge, iron oxide, singly or mixed, 1 part.

Very hard and extra strong compositions: (5) Zinc oxide, 2 parts; zinc chloride, 1 part; water to make a paste; (6) magnesium oxide, 2 parts; magnesium chloride, 1 part; water to make a paste.

XI. *Flour and Starch Compositions.*—(1) The well-known flaxseed poultice sets very tough, but does not stand water or condensed steam.

(2) Flour and molasses, made by making a stiff composition of the two. This is an excellent lute to have at hand at all times for emergency use, etc.

(3) Stiff paste of flour and strong zinc chloride solution forms a more impervious lute, and is more permanent as a cement. This is good for most purposes, at ordinary temperature, where it would not be in contact with nitric acid vapors or condensing steam.

(4) A mixture of dextrin and fine sand makes a good composition, mainly used as core compound.

XII. *Miscellaneous.*—(1) Litharge; glycerine.

Mixed to form a stiff paste, sets and becomes very hard and strong, and is very useful for inserting glass tubes, etc., in iron or brass.

For a high heat: (2) Alumina, 1 part; sand, 4 parts; slaked lime, 1 part; borax, ½ part; water sufficient.

Of course, there are an almost infinite number of lutes or cements, but, classified as these are, they represent the largest number of them. The formulas that are not original, or were kindly given by friends, have been seen in the literature one here and one there, and laid aside for a year or more, so I can hardly give the credit for them that I would like to.

A class of mixtures that can only be classified according to their intended use are core compounds. (1) Dextrin, about 1 part; sand, about 10 parts; with enough water to form a paste. (2) Powdered anthracite coal, with enough molasses to form a stiff paste. (3) Resin, partly saponified by soda lye, 1 part; flour, 2 parts; sand (with sufficient water), 4 parts.

These proportions are approximate, and the amount of sand can be increased for some purposes. (4) Glue, powdered, 1 part; flour, 4 parts; sand, 6 parts (with sufficient water).

For some purposes, the exact uses of which I am not familiar, the following mixture is used. It does not seem to be a gasket or a core compound: (5) Oats (or wheat) ground, 25 parts; glue, powdered, 6 parts; sal ammoniac, 1 part.

I would say in conclusion that in any works or laboratory it is very good to have some such compositions made up ready to use without delay when wanted. Just which one, depends on the nature of the manufacturing or other work done.

I hope that some of the material contained in this paper may prove of benefit to some here present.

Should Civil Engineering Schools Be Modeled After West Point.[1]

Whenever the suggestion is made that engineering students should be given courses in this or that new subject, the reply that comes quickest to the tongue is to the effect that already more subjects are taught than can be mastered by the average student in four years' time. Then a counter question is asked: What would you drop from the present courses to make room for your proposed course? The question is not an easy one to answer, but as engineering education is a subject of perennial interest to the old engineer as well as to the young, an attempted answer to this hypothetical question will be made.

That the four years of work in the average engineering college are years already crowded with subjects is manifest by a casual examination of catalogues, and when we come to inquire as to the hours of time that each instructor expects his students to devote daily to each subject, we are more than ever impressed with the fact that the students are "filled to the brim" with work.

A senior in one of the large engineering colleges recently told the writer that at the first of each year it had been his custom to go to each of the professors and instructors with this question: How many hours should I devote each week to each subject that you teach? Having thus received an estimate from the men best able to judge the time required to do justice to the respective subjects, he found that upon adding all the estimated hours together and dividing by seven, he had about thirty-five hours left for sleep and recreation during the week! This did not happen one year, but every year of the four. Needless to add, the student decided not to "do justice" to every subject.

If this condition of affairs is at all common, and we believe it is, what does it indicate? Unquestionably it points to absence of true leadership in arranging the courses of instruction. It indicates that the head of each department strives to force into the curriculum as much as possible of his own particular subjects, in a measure acting regardless of the work laid out by the heads of other departments. The result is that the most forceful instructors, and particularly those who are most severe in "marking" examination papers, crowd subjects other than their own into the background.

A professor who is "strong" in bridge engineering, makes bridge designing the feature of the college course. To him engineering unconsciously has become a term synonymous with strains and stresses in framed structures. His every effort is devoted to graduating men who will be a credit to him by virtue of their ability to assume responsible positions as bridge designers shortly after graduation. Numerous problems are given each week to the students, and the number of these problems is so great that but two lines of action remain open for the student. Either he must neglect other subjects, or get the solution of each problem from students who have neglected every other course of instruction.

It is well known to engineering graduates that one college makes a feature of bridge problems, another of railway problems, another of masonry construction, and so on. When one comes to look into the cause of this onesidedness, the reason is apparent, the cause being, as we have said, the lack of broad leadership in the person of the dean or president.

We may hear it urged that such leadership, while perhaps desirable, is not to be had as a rule so long as it remains a trait of human nature to enjoy doing most that which is done best. Each professor must be more or less one-sided in his experience and in his natural aptitude for doing certain kinds of engineering work, and being so he will unconsciously strive to mold the students as he himself is molded. If the president or dean is himself an engineer, and if he is a forceful man, then, it will be urged, he will force upon the college his own specialties, more or less to the exclusion of others. If he is not an engineer, then he will not be able wisely to map out any course, to say nothing of coordinating all the courses wisely.

As a solution of this difficult problem, there seems no better way than the organization of what might be termed "a board of strategy," representation on this board being given to every department of instruction in the college. Perhaps even a better plan would be the organization of such a board upon which the acknowledged leaders in every engineering college would have a place, as well as the acknowledged leaders in the different branches of those practicing the civil engineering profession. There has been an encyclopedia of literature written upon the subject of engineering education, and the result has been to bring engineers together on at least one point, namely, the wisdom of teaching only the fundamental principles of engineering science, leaving to subsequent years in the school of experience much that is now taught at college. Furthermore, the verdict has been against specialization in engineering colleges, so that nearly all engineers composing such a board of educational strategy can begin their work holding fundamental opinions in common.

We have had much talk, let us now have a little concerted action. Our theories have been elaborated, now let the rules of practice be formulated. If a few engineers still urge specialization, let them apply their theories to West Point—an engineering college that, while professedly military, has graduated scores of the most noted men in the civil engineering profession. In West Point they will see a refutation of all arguments in favor of specialization in civil engineering colleges. Moreover, they will find in West Point a model well worthy of consideration in virtue of what is not taught there. They will not find students there spending several hours a day, for several weeks, working on problems in chimney design, as is the case at one of our engineering colleges. They will not find students working in a similar manner testing innumerable samples of concrete, as at another college. They will not find students bending over drawing boards for weeks designing every type of bridge truss and every detail of every type, as at still another college. What they will find is: first, co-ordination of the courses, so as to give to each subject its due apportionment of time; second, disciplinary training that tends to make leaders of men; third, physical training that insures a long life of usefulness; fourth, moral training, that puts honor above every other consideration in life.

There are, it is true, several courses of instruction at West Point which may well be omitted from any purely civil engineering course; but for them should be substituted a training in engineering economics, which appears to have been but slightly touched upon. The military engineer is far less concerned with the cost of structures than with their serviceability for the purpose at hand; but in the mind of the young civil engineer the word cost should be printed in large letters. As a part of certain other courses the dollars and cents faculty of the young engineer can be cultivated, instead of being left as it now is to "soak in" after graduation.

The late A. M. Wellington, in editorially discussing engineering schools in these columns some years ago, laid great stress upon the advisability of conducting summer schools of surveying just as railway surveys are conducted, giving command of parties to the students in turn, for the purpose of teaching obedience to orders as well as for the purpose of cultivating the faculty of leadership. There is much in this suggestion that merits consideration. Indeed, it would be a carrying out of the West Point method of organization and discipline in a way that should prove of inestimable value.

The summer schools, moreover, possess a feature that is seldom emphasized enough by educators. We refer to the concentration of attention upon one subject at a time. It seems to be a trait of the human mind that it does its best work, not by intermittent effort, however regularly repeated, but by concentration of effort upon one subject, the only pauses being for physical exercise and recreation. The great inventions are not made by intermittent attention to a dozen projects every day, but by thinking on just one project at a time, day in and day out, resting the mind only by recreation and by sleep. This trait, it seems to us, explains the remarkable progress made by students of surveying in the summer schools; and it is deserving of careful consideration in mapping out any course of mental training.

To sum up we may say: The students of engineering colleges are, as a rule, left too much to act as suggested by their own immature judgment, or forced by fear of failure in examinations to devote hours to one subject and minutes to another, regardless of the actual value of the subjects. The time has come when educators are agreed upon the wisdom of teaching general principles, upon the wisdom of training, rather than cramming the mind, and upon the wisdom of caring for the moral and physical welfare of the student. It still remains to put these theories into practice, as has been done at only one college of engineering, and that one, strangely enough, the oldest and the most celebrated in the land—West Point.

1. *Engineering News.*

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. John W. Hatstat, since 1892, Superintendent of Works of the Hartford City (Conn.) Gas Light Company, has tendered his resignation. It becomes effective the 1st prox.

The proprietors of the Hollidaysburg (Pa.) Gas Company have made terms with the Altoona (Pa.) Gas Company, whereby the latter will furnish the former with its supply. A high pressure service line between the two points has been arranged for.

The gas plant at Boise City, Idaho, is virtually completed.

At the annual meeting of the Binghamton (N. Y.) Gas Company the following officers were elected: Directors, Emerson McMillin, J. M. Stevens, J. W. Manier, W. G. Phelps, Geo. W. Dunn, S. J. Hirschmann, C. M. Stone, George F. O'Neill and C. C. Jackson; President, Emerson McMillin; First Vice-President, James W. Manier; Second Vice-President, J. M. Stevens; Treasurer, Robt. W. Manier; Secretary, Walter B. Mahoney; Assistant Secretary and General Manager, Fred. B. Wheeler.

A correspondent in Louisville, Ky., writing under date of the 10th inst., says: "The General Council, in the opinion of City Attorney Stone, has the right to fix the maximum price to be charged for gas by the Kentucky Heating Company. Some time ago the Kentucky Heat-

ing Company gave notice of its intention to advance the rates on gas to private consumers. The right of the Company to advance the rates was questioned by some of the patrons of the Company and a resclution was adopted by the General Council directing the City Attorney to prepare an official opinion on the question. Col. Stone has had the question under consideration for several weeks, and this week delivered a written opinion which was read in both Boards. The conclusion reached by the City Attorney is in effect that the Kentucky Heating Company cannot advance the price of gas if the General Council desires to interfere. The opinion in part follows: 'The General Council has power, in my opinion, to fix the maximum price of all gas furnished in the city by the Kentucky Heating Company, except where its patrons have made and entered into a contract with said Company to pay it a price for natural gas for fuel or heating purposes in excess of the maximum price that may be prescribed therefor by ordinance. In that case, the General Council could not lawfully impair the obligation of such contracts, for, as above stated, in the ordinance of August 11, 1888, it is expressly provided, that said Company (meaning the Kentucky Rock Gas Company, or its successor) shall furnish natural gas for fuel or heating purposes to the citizens or city by contract made between the parties.'"

MR. JOSEPH W. BOMAN, of Fort Dodge, Ia., has been appointed Assistant Engineer of construction on the plant that is being built in Houghton, Mich., for the Portage Lake Gas and Coke Company.

MR. ARTHUR B. ALLEN has resigned from the service of the Penn Yan (N. Y.) Gas Company.

THE Derby (Conn.) Company's new capitalization "rights" are payable in full the 30th inst.

A CORRESPONDENT in Rutland, Vt., writing under date of the 13th, inst., says: "The Peoples Gas Light Company of this city is doing a fine business, as it should, for its service is good, its officers are men who know what they have to sell and with whom they have to deal, and its selling rates are of the liberal sort. On June 1, 1902, 403 meters were in use; June 1, 1904, 800 are in duty. June 1, 1902, about 25 gas ranges were on the lines; now 500 are taking gas. In 1901 the Company's records show that 4,434,300 cubic feet of gas were consumed; in 1903 the output was 13,439,500 cubic feet, and the average increase per month for the current year over 1903 figures 17 per cent. In May, 40 ranges were placed, and the record seems to show that those in charge made no mistake when the Company placed in charge of its fortunes such men as David Fox, Jr., as General Manager, and Roger W. Polk, as Superintendent. Time was when the people in the 'Marble' State City laughed if gas were spoken of as a useful agent—in fact, I would not have to look back of 1901 for my evidence—but things are changed, all to the benefit of those who know that something may be 'obtained oftener by liberality than by the laying on of hands.'"

AT the annual meeting of the Nanaimo (B. C.) Gas Company the shareholders had good reason for congratulation over the showing made for the year from the official reports. The officers elected were: President, J. R. Milne; Vice-President, Thomas Shotbolt; Secretary and Treasurer, W. K. Leighton.

AT the annual meeting of the shareholders in the Georgetown (D. C.) Gas Company the officers elected were: Directors, M. J. Adler, S. T. Brown, John Marbury, Wm. A. Leetch, Robt. D. Weaver and Wm. B. Orme. President, W. B. Duble; Vice-President, M. J. Adler; Secretary and Treasurer, F. P. Leetch; Superintendent and General Manager, Robt. L. Middleton.

IF one were solely guided in his belief over matters reported upon by the daily press he could not fail, having read the press stories, to feel certain that the plant of the Greeley (Col.) Gas Company was blown out of existence through an explosion which occurred there in the morning of the 5th inst. The plain facts in the Greeley happening, as reported to us by the President of the Company, Mr. G. J. Spear, are as follows: "We had a little blow out here yesterday, caused by a defective casting in one of the valves. The resultant explosion caused damage amounting to perhaps $300 at the very outside. We resumed manufacturing operations early in the afternoon, with practically no annoyance to our customers."

AT the annual meeting of the Reading (Pa.) Gas Company the officers elected were: President, Wm. B. McIlvain; Secretary, Jno. N. Reilly; Board of Managers, Chas. Breneiser, Isaac Heisler, Jno. J. Kutz, Wm. D. Smith, Wm. McIlvain and Chas. H. Schaeffer.

A CORRESPONDENT incloses the following from Waterbury, Conn.: "The Connecticut Railway and Lighting Company, which operates, as your readers know, important trolley railway, gas and electric lighting systems in this State, has issued a comparative statement of its business for the first four months of the present year and of 1903. Only gross earnings are shown. From operation of the trolley lines the earnings were $354,981, as against $307,233 in 1903. For the six months ending Dec. 31, 1903, the trolley roads earned $656,470 and the operating expenses were $477,939. The earnings for the six months are regarded as satisfactory, in view of the Waterbury strike, which cut off gross earnings in July and August by about $25,000. For the year ending June 30, 1903, there was a deficit owing to the Bridgeport strike and the beginning of the troubles at Waterbury."

ON the 1st of August the shareholders of the United Gas and Electric Company, of Sedalia, Mo., will hold a special meeting for the purpose of determining whether or not the Company's properties shall be mortgaged in the sum of $1,000,000.

"THE contention between the authorities of San Francisco and the San Francisco Gas and Electric Company, over the public lighting of that city would seem to have been settled, if the following letter from the Company to the authorities may be taken as evidence thereon," so writes a correspondent in San Francisco, whose letter is dated the 10th inst.: "Last year under drastic competition you received bids as low as 37½ cents per 1,000 cubic feet for gas and .0299 per K. W. H. for electric current. Even with these unprofitable rates the city requirements would have amounted to over $315,000. In the hope of inducing larger future appropriations, and to assist the various committees in proving the value of every night lighting to the city, a blanket contract was made for the sum of $300,000. That contract was not and should not be considered a basic rate for future contracts. In the budget recently presented $320,000 has been allotted for lighting, which is approximately $30,000 less than the proposed service to the city would cost at low rates. In the desire, however, to preserve the good relations which have hitherto existed and which we hope to maintain, with the hope that our corporation will become a beneficial factor in the life of the city, and with the belief that future appropriation will afford more adequate compensation for the services rendered, I am authorized by my directors to agree for the above-mentioned sum of $320,000, payable in monthly instalments of $28,666.66: First, to supply all the gas and electricity needed for every night lighting and other municipal purposes, as under our present contract with the city, but not to include the lighting of public libraries nor the furnishing of motor power; second, to install 50 additional arc lights and 100 additional Welsbach lamps, making a total of 5,235 Welsbach lamps and 1,062 arc lights. The above to be furnished for the year commencing July 1, 1904, and ending June 30, 1905. The installation of the new gas lamps is to begin within 10 days after we shall have been furnished with a list of the locations, and to be made at the rate of at least 15 per week. All gas lamps are to be installed where we now have mains, and reasonable discretion is to be exercised in the location of the additional arc lamps. The installation of the proposed 150 extra lights will cost this Company approximately $20,000, which, although a capital expenditure, is one that necessarily carries a large annual replacement and depreciation charge, which may reasonably be put at $4,000 per year."

IT seems to be permanently settled, after much haggling, that the new manufacturing plant of the Otto Gas Engine Company will be located in Wilmington, Del.

MR. H. L. RICE has resigned the position of General Manager to the Macon (Ga.) Gas Light and Water Company.

MR. J. B. GRIMSHAW, of Detroit, Mich., has been appointed Manager of the Wyandotte (Mich.) Gas Company.

THE plant and franchises of the Plattsmouth (Neb.) Gas and Electric Light Company were recently sold at public auction, the purchaser being the New Hampshire Bank Company, trustee under the existing mortgage, which amounts to $33,000. The sale was effected at something under $14,000.

MR. A. F. KERSTING has resigned the position of Superintendent of works to the Pittsfield (Mass.) Coal Gas Company. His successor is Mr. Edwin C. Peebles.

THE "combined" gas, electric lighting and street railway interests of Rochester, N. Y., are to carry a capital burden amounting to only $11,000,000.

THE Malden (Mass.) Company is arranging for an extention of its mains to the outlying district of Linden.

Electricity says that an electric furnace for laboratory work has recently been invented by Prof. H. V. Morse, of Johns Hopkins University. Continuing, our contemporary says: "This furnace is radically different from any heretofore brought out and is said to meet every requirement for laboratory work in chemistry. In order that satisfactory results may be obtained in the many forms of heating necessary in laboratory practice four conditions must be satisfied: First, the heat must be developed economically; second, it must be possible to obtain definite temperatures; third, it must be possible to maintain constant temperatures for long periods; fourth, products of combustion must not be allowed to come in contact with the substances heated. Chemists have long seen that the solution of the problem was to be looked for in the application of the electric current, which yields no products of com-

bustion and which can be developed at a constant and regular rate. Prof. Morse's electric heater consists of an ordinary copper oven incased in a box doubly lined with asbestos, with air space between, the whole covered with aluminum paint, which is not affected by high temperatures, is a very poor heat radiator and preserves the asbestos from shredding. This arrangement practically prevents any loss of heat by radiation. The source of heat is in the stove, which is placed within the copper oven. The construction of this stove is the ingenious part of the apparatus and requires the highest type of experimental skill. It is constructed of a number of parallel slabs of soapstone coated with graphite, the soapstone being unaffected by the heat. The graphite must be evenly distributed over the slabs of soapstone, in order that the heat may be developed uniformly over the surface. The oven itself is not so difficult of construction, but the making of the heating apparatus within, through which the electric current has passed, has formed the great stumbling block in the way of former investigators. The use of soapstone in constructing the heater is the result of the remarkable inventive genius for which Prof. Morse is well known. The furnace has been found to work admirably and can be operated, so it is claimed, at a cost of one cent a day. A constant temperature of 150° can be obtained for 8 hours at a stretch at a cost of three-fourths of a cent. It is probable that Prof. Morse's furnace will entirely displace the gas furnaces now in general use, and it is certain it will add much to the exactness with which chemical processes may be carried out."

The Market for Gas Securities.

The developments during the week in the city gas share market were all in favor of those who look for higher prices. The gain in Consolidated figures something over 3¼ points, the closing price to-day (Friday) being returned at 193¼ to 193½. There was considerable trading in the rights, which were quoted at 16¼ to 16½. Actual investment money placing can safely be taken as the reason for the advance, the continued ease in the money market also assisting.

Brooklyn Union quotations are of the tritest normal sort, the returns showing 212 to 225. These shares are very cheap, even at the asking price. Peoples, of Chicago, remains steady at the bargain rate of 97, and Baltimore Consolidated has been quite active, quite a bit of stock having been disposed of in the week at good fractions between 71 and 72. Lacledes still remain very uncertain, although the preferred looks a purchase at the average between bids of buyers and offerers. Louisville gas is in good demand, and a like statement applies to Cincinnati gas and electric.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 Wall Street, New York City.

June 20.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	193¼	193½
Central Union, Bonds, 5's	3,000,000	1,000	106½	106⅝
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,500,000	1,000	118	120
Metropolitan	658,000	..	108	112
Mutual	3,500,000	100	270	300
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co..				
Bonds, 5's	11,000,000	1,000	105⅛	106
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	34	..
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	..	..
Northern Union, Bonds, 5's	1,250,000	1,000	102¾	105⅛
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	109¼	111
" 1st Con. 5's	1,500,000	..	106	108
Standard	5,000,000	100	125	13
Preferred	5,000,000	100	145	155
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	117
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	212	225
" " Bonds (5's)	15 000,000	1,000	113	115
Bay State	50,000,000	50	⅛	3/16
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	500,000	1,000	93	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	3¾	4
" " Bonds, 5's	5,250,000	1,000	12¾	..
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas and Electric Co	29,500,000	100	102	102¼
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	101	101½
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¼	89¼
Preferred	3,026,500	100	107½	109
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	71	..
Mortgage, 6's	3,500,000	..	..	118
Chesapeake, 1st 5's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	380,000	1,000	86	90
Consolidated G. & E. Co.'s. Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,825,500	50	..	50
" Prior Lien 5's	5,503,000	1,000	99⅛	100
Detroit Gas Co., 5's	251,000	1,000	75	75¼
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	245	255
Hudson County Gas Co., of New Jersey	10,500,000	..	67	68
" Bonds, 5's	10,500,000	..	103½	104½
Indianapolis	2,000,000	..	60	70
" Bonds, 6's	2,650,000	..	103½	103⅝
Jackson Gas Co	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	90	100
Preferred	2,500,000	100	75	100
Bonds	10,000,000	1,000	109½	110
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,00[illegible]	1,000	60	65
Louisville	2,570,000	50	136	140
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	107½	108¼
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	184¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,800,000	..	105	105¾
New Haven	1,000,000	25	64	70
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	96¾	97
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	15,800,000	100	58¾	58¾
St. Joseph Gas Co.				
" 1st Mtg. 5's	751,000	1,000	92	96½
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	118	116
Extension, 6's	600,000	1,000	113½	115
General Mortgage, 5's	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	46	49
Bonds	2,047,000	1,000	94	96
Washington, D. C	2,600,000	20	285	287½
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del	600,000	50	230	..

Advertisers' Index.

GAS ENGINEERS. Page

A. E. Boardman, New York City 992
Baxter & Young, Detroit, Mich 992
B. E. Chollar, St. Louis, Mo 978
David Leavitt Hough, New York City 992
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 984
Frank D. Moses, Trenton, N. J 979
Fred. Bredel Co., Milwaukee, Wis 980
Frederic Egner, Washington, D. C 978
Geo. G. Ramsdell, New York City 977
Geo. R. Rowland, New York City 982
Humphreys & Glasgow, New York City 993
J. F. W. Jost, Philadelphia, Pa 977
Kerr Murray Mfg. Co., Fort Wayne, Ind. 992
The Gas Machinery Co., Cleveland, O 980
The Jeffrey Manufacturing Co., Columbus, O 990
The Western Gas Construction Co., Fort Wayne, Ind.. 960
United Gas Improvement Co., Philadelphia, Pa 987
Wm. Henry White, New York City 995

GAS WORKS APPARATUS AND CONSTRUCTION.

A. E. Boardman, New York City 992
Bartlett, Hayward & Co., Baltimore, Md 993
Baxter & Young, Detroit, Mich 992
Connelly Iron Sponge and Governor Co., New York City 989
Continental Iron Works, Brooklyn, N. Y 991
Cruse-Kemper Co., Philadelphia, Pa 979
Davis and Farnum Mfg. Co., Waltham, Mass 992
Deily & Fowler, Philadelphia, Pa 995
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 984
Frank D. Moses, Trenton, N. J 979
Fred. Bredel Co., Milwaukee, Wis 980
G Shepard Page's Sons, New York City 992
Humphreys & Glasgow, New York City 993
Isbell-Porter Company, New York City 994
Kerr Murray Mfg. Co., Fort Wayne, Ind 992
Lloyd Construction Co., Detroit, Mich 982
Logan Iron Works, Brooklyn, N. Y 991
Quintard Iron Works, New York City 993
R. D. Wood & Co., Philadelphia, Pa 994
Riter-Conley Mfg. Co., Pittsburg, Pa 995
Stacey Mfg. Co., Cincinnati, O 996
The Connersville Blower Company, Connersville, Ind... 997
The Gas Machinery Co., Cleveland, O 980
The Jeffrey Manufacturing Co., Columbus, O 990
The Western Gas Construction Co., Fort Wayne, Ind.... 960
United Gas Improvement Co., Philadelphia, Pa 987

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md 993
B. E. Chollar, St. Louis, Mo 978
Economical Gas Apparatus Construct'n Co, Toronto, Ont. 984
Fred. Bredel Co , Milwaukee, Wis 980
Humphreys & Glasgow, New York City 993
The Gas Machinery Co., Cleveland, O 980
The Western Gas Construction Co., Fort Wayne, Ind.... 960
United Gas Improvement Co., Philadelphia, Pa 987

SCRUBBERS AND CONDENSERS.

Continental Iron Works, Brooklyn, N.Y 994
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 984
Fred. Bredel Co., Milwaukee, Wis 980
Kerr Murray Mfg. Co., Fort Wayne, Ind 992
Logan Iron Works, Brooklyn, N. Y 996
R. D. Wood & Co., Philadelphia, Pa 994
Riter-Conley Mfg. Co., Pittsburg, Pa 995
Stacey Mfg. Co., Cincinnati, O 995
The Gas Machinery Co., Cleveland, O 980
The Western Gas Construction Co., Fort Wayne, Ind.... 960

PRODUCER POWER PLANTS.

Economical Gas Apparatus Construct'n Co., Toronto, Ont. 984
R. D. Wood & Co., Philadelphia, Pa 994

TAR AND CARBONIC ACID EXTRACTOR.

Economical Gas Apparatus Construct'n Co., Toronto, Ont. 984
Fred. Bredel Co., Milwaukee, Wis 980
Stacey Mfg. Co., Cincinnati, O 995
The Gas Machinery Co., Cleveland, O 980
The Western Gas Construction Co., Fort Wayne, Ind... 960

AMMONIA CONCENTRATORS.

Fred. Bredel Co., Milwaukee, Wis 980
Michigan Ammonia Works, Detroit, Mich 975
The Gas Machinery Co., Cleveland, O 980
The Western Gas Construction Co., Fort Wayne, Ind... 960

GAS METERS.

American Meter Co., New York and Philadelphia 999
Detroit Meter Company, Detroit, Mich 999
D. McDonald & Co., Albany, N.Y 997
Helme & McIlhenny, Philadelphia, Pa 999
John J. Griffin & Co., Philadelphia, Pa 1000
Keystone Meter Co., Royersford, Pa 998
Maryland Meter and Mfg. Co., Baltimore, Md 998
Metric Metal Co., Erie, Pa 999
Nathaniel Tufts Meter Co., Boston, Mass 998

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia..... 999
D. McDonald & Co., Albany, N. Y..... 997
Helme & McIlhenny, Philadelphia, Pa..... 999
John J. Griffin & Co., Philadelphia, Pa..... 1000
Keystone Meter Co., Royersford, Pa..... 998
Nathaniel Tufts Meter Co., Boston, Mass..... 998

PREPAYMENT METER ATTACHMENTS.

Reeves Mfg. Co., New Haven, Conn..... 950

GAS AND WATER PIPES.

Davis & Farnum Mfg. Co., Waltham, Mass..... 992
Donaldson Iron Co., Emaus, Pa..... 984
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 984
M. J. Drummond & Co., New York City..... 984
R. D. Wood & Co., Philadelphia, Pa..... 991
Warren Foundry and Machine Co., New York City..... 984

GAS COALS.

Berwind-White Coal Mining Co., New York and Phila. 993
Perkins & Co., New York City..... 990
Westmoreland Coal Co., Philadelphia, Pa..... 991

SPECIALTIES FOR OIL AND PIPE LINES.

S. R. Dresser, Bradford, Pa..... 981

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., N.Y. City..... 984

MAIN AND SERVICE LAYING.

Sullivan Bros., Flushing, N. Y..... 940

GAS TAPPING MACHINES.

George Light, Dayton, O..... 984
H Mueller Manufacturing Company, Decatur, Ills..... 977

CANNEL COALS.

Perkins & Co., New York City..... 990

STOKING MACHINERY.

G. A. Bronder, New York City..... 989

CONVEYORS.

Adam Weber Sons, New York City..... 988
C. W. Hunt Company, New York City..... 981
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 984
Fred. Bredel Co., Milwaukee, Wis..... 98
G. A. Bronder, New York City..... 989
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 992
The Brown Hoisting Machinery Co., Cleveland, O..... 991
The Gas Machinery Co., Cleveland, O..... 981
The Jeffrey Manufacturing Co., Columbus, O..... 990
The Link-Belt Engineering Co., Philadelphia, Pa..... 981
The Link-Belt Machinery Co., Chicago, Ills..... 984
The Western Gas Construction Co., Fort Wayne, Ind... 960
United Telpherage Co., New York City..... 976

CHARGING BARROWS & COAL WAGONS.

Kerr Murray Mfg. Co., Fort Wayne, Ind..... 992
Stacey Mfg. Co., Cincinnati, O..... 995

GAS ENRICHERS.

Standard Oil Co., New York City..... 951
Sun Company, Pittsburg, Pa..... 991
The Sun Oil Co., Pittsburg, Pa..... 991

COKE CRUSHERS.

C. M. Keller, Columbus, Ind..... 971
Fred. Bredel Co., Milwaukee, Wis..... 980
The Jeffrey Manufacturing Co., Columbus, O..... 990

STEAM BLOWER FOR BURNING BREEZE.

The Connersville Blower Company, Connersville, Ind... 997

ECONOMIZERS.

Green Fuel Economizer Co., Matteawan, N.Y..... 982

GAS GAUGES.

The Bristol Co., Waterbury, Conn..... 982

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City 989
Fred. Bredel Co, Milwaukee, Wis..... 980
Isbell-Porter Co., Newark, N. J..... 994
R. D. Wood & Co., Philadelphia, Pa..... 994

CEMENTS.

C. L. Gerould, Bloomington, Ind..... 988

RETORTS AND FIREBRICKS.

Adam Weber Sons, New York City..... 988
Baltimore Retort and Firebrick Co., Baltimore, Md..... 988
Brooklyn Firebrick Works, Brooklyn, N. Y..... 988
Henry Maurer & Son, New York City..... 988
James Gardner, Jr., Co., Pittsburg, Pa..... 988
J. H. Gautier & Co., Jersey City, N. J..... 988
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 988
Missouri Firebrick Co., St. Louis, Mo..... 988
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 978
The Kreischer Brick Mfg. Co., New York City..... 988

INCLINED RETORTS.

Adam Weber Sons (Graham, Morton [England] System) 988
Fred. Bredel Co., Milwaukee, Wis..... 980
Geo. G. Ramsdell, New York City..... 978
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 978

VERTICAL S'S.

Adam Weber Sons (Oscar B. Weber's Construction)..... 988
Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System) 989
Fred. Bredel Co., Milwaukee, Wis..... 980
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 978

VERTICAL CHARGING & DISCHARGING MACHINERY.

Adam Weber Sons, New York City..... 988

REGENERATIVE FURNACES.

Adam Weber Sons, New York City..... 988
Bartlett, Hayward & Co., Baltimore, Md..... 993
Fred. Bredel Co., Milwaukee, Wis..... 980
J. H. Gautier & Co., Jersey City, N. J..... 988
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 983
Missouri Firebrick Co., St. Louis, Mo..... 988
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 978

SELF-SEALING MOUTHPIECE DOORS.

Continental Iron Works, Brooklyn, N.Y. 994
Fred. Bredel Co., Milwaukee, Wis..... 990
Isbell-Porter Co., Newark, N. J..... 994
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 992
Logan Iron Works, Brooklyn, N.Y..... 996
R. D. Wood & Co., Philadelphia, Pa..... 991
Stacey Mfg. Co., Cincinnati, O..... 995
The Gas Machinery Co., Cleveland, O..... 980
The Western Gas Construction Co., Fort Wayne, Ind.. 960

CHIMNEY CONSTRUCTION.

Adam Weber Sons, New York City..... 988

INCANDESCENT GAS LAMPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 980
General Gas Light Co., Kalamazoo, Mich..... 979
Geo. G. Ramsdell, New York City..... 977
Welsbach Company, Gloucester, N. J..... 986

(*Continued on page 976.*)

DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO., N. W. CORNER BROAD AND ARCH STS., PHILADELPHIA, PA., June 8, 1904.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable July 15th, 1904, to stockholders of record at the close of business, June 30, 1904. Checks will be mailed.

1514-5 LEWIS LILLIE, Treasurer.

WANTED,

Position as General Manager, Superintenden or Engineer of a Gas Company,

By a man competent to carry on any kind of construction work, to operate any sort of gas plant, or to produce results in the line of obtaining new business.

1515-1 Address, "S. E. G.," care this Journal.

SUPERINTENDENT WANTED

An Eastern gas company, sending out about a million per day, wants a superintendent who can show by results in monthly reports that he understands thoroughly the manufacture and distribution of coal and water gas. To insure attention, replies should state fully age, experience, salary expected, references, etc. Address, "A. B.,"

1514-2 Care this Journal.

WANTED,

A Bright, Reliable, Competent Young Man,

Familiar with the purification of gas. Steady position to the right party.

1515-2 Address, "INTELLIGENT," care this Journal.

PROPOSALS FOR TAR.

OFFICE OF SUPERINTENDENT OF CITY GAS WORKS, RICHMOND, VA., June 6th, 1904.

Sealed proposals will be received at this office, room 9, first floor, City Hall, until Friday, July 1, 1904, at 5 o'clock, P.M., for the purchase and removal of tar that may be produced at these works; specific gravity or quality not to be guaranteed. Such bids to be submitted separately for two, three and five years, beginning July 1, 1904; say, 4,000 barrels per annum, more or less, same to be delivered from our storage tanks at these works. The contractor will be required to furnish suitable receptacles to receive the tar, and remove same at his expense, from time to time, as may be required to prevent an overflow of the storage tanks. Monthly payments will be required for each month's delivery. The successful bidder will be required to execute a trust company's bond in the sum of $2,000 for the faithful performance of the contract. Bids must be submitted, per barrel of 50 gallons, sealed and marked "Proposals for Tar," and addressed to the undersigned. The Committee on Light reserves the right to reject any and all bids offered. W. A. KNOWLES, SUPT.

1514-2

WANTED,

A First-Class Superintendent and Manager of Gas and Water Works,

In a large Southern city. Write fully, stating experience, salary expected, age, references, etc. Address, "IRON,"

1513-3 Care this Journal.

WANTED,

Second-Hand Station Meter.

Not less than 7-foot. Must be in good condition. Address, giving necessary information, "G. F. D.,"

1511-tf Care this Journal.

FOR SALE,

One Section Wrought Iron Hydraulic Main, with Stiness tar take-off, for 3 benches of 6's.
One Section Main, for 4 benches of 6's.
Standpipes, Bridgepipes, Mouthpieces with Self-sealing Lids, for 7 benches of 6's.
One Sinuous Friction Condenser.
One Walker Tar Extractor.
One Standard Scrubber.
Four Purifiers, 10 by 16 by 3; complete. Connections above apparatus, 10-inch.
One 50 Horizontal Return Tubular Boiler.

All of the above apparatus is in good condition, and to be sold, as the company has been obliged to purchase larger for its new works. Address, TAUNTON GAS LIGHT CO.,

1514-5 Taunton, Mass.

FOR SALE,

No. 3 ROOTS' EXHAUSTER,

Six-inch connections. In fine condition. Also,

200 Three-Light Standard Meters,

repaired. Address, GAS COMPANY,

1513-3 WATERTOWN, N. Y.

FOR SALE.

Three Davis & Farnum Purifiers,

Twelve feet by 24 feet by 4 feet. Also,

One 50-Horse Power Bigelow Boiler.

All in good condition. Address,

PAWTUCKET GAS COMPANY,

1506-tf PAWTUCKET, R. I.

FOR SALE.

Lot of second-hand

THREE-LIGHT METERS,

in splendid condition; as good as new. Also one

NINE-FOOT STATION METER,

with a capacity of 1,000,000 cubic feet per 24 hours. Address, "VINDEX,"

1508-tf Care this Journal.

FOR SALE.

Gas Plant in Good, Growing Town,

Making good net profit now, and with practical gas man can be doubled and more.

1511-6 Address, "K.," care this Journal.

Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

IMPROVED AMMONIA CONCENTRATOR.

About 100 in use. Write to

STROH & OSIUS, Patentees, or
MICHIGAN AMMONIA WORKS, - Detroit, Mich.

(*Continued from page 975.*)

BURNERS.
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 980
Wm. M. Crane Co., New York City..... 981

LAVA GAS TIPS.
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 980

STREET LAMPS.
Thos. T. W. Miner, New York City..... 981
Welsbach Street Lighting Co., New York and Phila.... 986

PURIFIERS.
Connelly Iron Sponge and Governor Co., New York City. 989
Fred. Bredel Co., Milwaukee, Wis..... 980
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 992
R. D. Wood & Co., Philadelphia, Pa..... 994
Stacey Mfg. Co., Cincinnati, O..... 995
The Western Gas Construction Co., Fort Wayne, Ind... 960

PURIFYING MATERIALS.
Connelly Iron Sponge and Governor Co., New York City 989

VALVES.
Continental Iron Works, Brooklyn, N. Y..... 994
Economical Gas Apparatus Construct'n Co., Toronto, Ont 984
Isbell-Porter Co., Newark, N. J..... 994
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 992
Ludlow Valve Manufacturing Co., Troy, N.Y..... 981
R. D. Wood & Co., Philadelphia, Pa..... 994
Stacey Mfg. Co., Cincinnati, O..... 995
The P. H. & F. M. Roots Co., Connersville, Ind..... 983
The Western Gas Construction Co., Fort Wayne, Ind.... 960

EXHAUSTERS.
Connelly Iron Sponge and Governor Co., New York City 989
Isbell Porter Company, Newark, N. J..... 994
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 992
The Connersville Blower Company, Connersville, Ind... 997
The P. H. & F. M. Roots Co., Connersville, Ind..... 983

ELECTRICAL APPARATUS.
Wm. Henry White, New York City..... 995

PURIFIER SCREENS.
John Cabot, Hoboken, N. J..... 980

GRATE BARS.
F. Ferguson & Son, Hoboken, N. J. 984

GAS STOVES.
American Meter Co., New York and Philadelphia..... 985
Detroit Stove Works, Detroit and Chicago..... 998
Keystone Meter Co., Royersford, Pa..... 998
Maryland Meter and Manufacturing Co., Baltimore, Md. 998
Nathaniel Tufts Meter Co., Boston, Mass..... 998

HOT WATER HEATERS.
Humphrey Co., Kalamazoo, Mich..... 976

GASHOLDER TANKS.
J. P. Whittier, Brooklyn, N.Y..... 982

GASHOLDERS.
Bartlett, Hayward & Co., Baltimore, Md..... 993
Continental Iron Works, Brooklyn, N.Y..... 994
Cruse-Kemper Co., Philadelphia, Pa..... 979
Davis & Farnum Mfg. Co., Waltham, Mass..... 992
Delly & Fowler, Philadelphia, Pa..... 996
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 984
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 992
Logan Iron Works, Brooklyn, N Y..... 996
R. D. Wood & Co., Philadelphia, Pa..... 994
Riter-Conley Mfg. Co., Pittsburg, Pa..... 995
Stacey Mfg. Co., Cincinnati, O..... 995

STORAGE TANKS.
Stacey Mfg. Co., Cincinnati, O..... 995

PAINTS.
National Paint Works, New York City..... 992

PATENTS, TRADE-MARKS, COPYRIGHTS.
Royal E. Burnham, Washington, D. C..... 980

BOOKS, ETC.
Scientific Books..... 978
Self-Instruction for Students in Gas Manufacture..... 990
Finances of Gas and Electricity Mfg. Enterprises..... 981
Practical Handbook on Gas Engines..... 981
Gas and Gas Works..... 978
Electric Gas Lighting..... 984
Coal Tar and Ammonia..... 990
Gas Analyst's Manual..... 996
Field's Analysis, 1902..... 976
Gas Flow Computers..... 991
Excerpts from Reports of Gas Commissioners..... 999
Directory of Gas Companies..... 995
Gas Engineer's Laboratory Handbook..... 994
Gas Engineer's Pocket-Book..... 988
Poole on Fuels..... 991
Binders..... 991

The method of operation: Electricity does the work; man the directing. Upon closing the switch the loaded bucket is elevated, transported, and the coal or coke deposited either into hoppers or upon screens, or anywhere throughout the works. The coke, in steel buckets, can be quenched and then carried to storage piles or cars. All under the control of one man. Any load hoisted and conveyed, at high speeds, either by single Telphers or in trains. (Circulars give details.)

TELPHERAGE
IN
GAS WORKS.

United Telpherage Co.,
20 BROAD ST.,
NEW YORK, U. S. A.

THE SUMMER SEASON
Means More Hot Baths.

Furnish your consumers the easiest, quickest, cleanest and most economical means of securing Hot Baths by recommending or selling the

Humphrey Crescent Instantaneous Water Heaters.

Price, $16 to $45, GUARANTEED.

The No. 6, price $25, here illustrated, will heat three gallons of water per minute 50° in temperature, supplying a large family at any time with all the Hot Baths wanted.

We Make Quick Shipments.

Send to-day for prices to HUMPHREY CO., Kalamazoo, Mich.

FIELD'S ANALYSIS
For the Year 1902.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 34th Year of Publication.

COMPILED AND ARRANGED BY JOHN W. FIELD,
Secretary and General Manager of The Gas Light and Coke Company, London.

PRICE, $5. FOR SALE BY
A. M. CALLENDER & CO., 42 PINE ST., NEW YORK CITY.

The Latest Novelty in Gas Lighting is the

PATENT INVERTED INCANDESCENT GAS BURNER.

One third full size.
Price: Burner with Mantle and Globe, $2.50.

No. 1 BURNER.

The most up-to-date and economical system of gas lighting, artistic in appearance, absolutely shadowless, and readily attached to existing fittings.

A BRILLIANT WHITE LIGHT OF 65 STANDARD CANDLE POWER.

Gas Consumption only 3 Cubic Feet per Hour.

The decorative appearance of Electric Light at one-eighth the cost.

THE "BIJOU" BURNER

Is the nearest approach to Electric Light, and lends itself more than any other gas burner to private house lighting, having an exceedingly pretty effect, especially when fixed in clusters of two, three or five lights.

20 standard candle power.

Consumption of Gas, 1 foot per hour.

One-third full size.
Price: Burner with Mantle and Globe, $2.

The New Inverted Incandescent Gas Lamp Co., Ltd.,

GEO. G. RAMSDELL, Agent,

530 BROADWAY, • • NEW YORK.

MUELLER GAS MAIN TAPPING MACHINES.

C—0 0.

For dry pipe tapping a low cost machine can be substituted for the high priced one used in pressure tapping, and the general wear and tear will be less expensive.

The Mueller "Regular" Tapping Machine is an ideal substitute to use in work of this kind. It is substantially made, and will do open tapping just as well as the most expensive machine.

Mueller Tapping Machines are made for open tapping, for tapping under pressure, and for tapping light weight pipes in which connections cannot be made without the use of a service clamp. The machine illustrated here is used for open tapping only. We also make gas cocks, meter connections and other accessories for gas works use.

Each tapping machine is given a test which is as near like actual service use as possible, and is *unconditionally guaranteed.*

Mueller Tapping Machines are on exhibit in the Palace of Manufactures, World's Fair.

H. MUELLER MFG. CO.,

DECATUR, ILL., U. S. A.

PARKER-RUSSELL MINING AND MFG. CO.,

OF ST. LOUIS, MO.,

PROPRIETORS OF THE

OAK HILL GAS RETORT AND FIREBRICK WORKS.

ST. LOUIS OFFICE: 417 Pine Street. NEW YORK OFFICE: Aldrich Court, 45 Broadway.

WE MAKE A SPECIALTY OF WATER GAS LININGS AND CHECKER BRICK.

Half and Full Depth Benches of Our Own Design, Containing 6, 8 or 9 Retorts.

SLOPERS.--We have perfected plans of INCLINED RETORT BENCHES, designed to meet conditions prevailing in America, and constructed entirely of American materials.

We Build Benches Complete. Ready for Gas Making. Also,

RETORT HOUSES,

COAL and COKE CONVEYING MACHINERY.

Plans, Specifications and Estimates Cheerfully Furnished.

CORRESPONDENCE SOLICITED.

ALL CONTRACTS MADE AS OF ST. LOUIS, MO.

FREDERIC EGNER,

Gas Engineer,

NORFOLK, VA.,

May be consulted with reference to estimates of cost for new, or appraising actual value of existing works; utility of proposed or patented processes; relative earning power to capitalization, and management.

Chollar's System of Gas Purification.

THE PURIFIED GAS REVIVES THE FOULED OXIDE.

SCIENTIFIC BOOKS.

ELECTRIC GAS LIGHTING. By H. S. Norrie. 50 cents.

GAS ANALYST'S MANUAL. By J. Abady. $6.50.

COX'S GAS FLOW COMPUTER. $2.50.

FIELD'S ANALYSIS, 1902. $5.

GAS AND GAS WORKS. By Hughes and O'Connor. $2.

POOLE ON FUELS. By Herman Poole. $3.

GAS ENGINEER'S POCKET-BOOK. By Henry O'Connor $3.50.

TECHNICAL GAS ANALYSIS. By Winkler & Lunge. $4.

GAS CONSUMER'S HANDYBOOK, by Wm. Richards. 20 cents.

PRACTICAL TREATISE ON HEAT. By Thomas Box. 2d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*, $5. Vol. II., *Lighting*, $4.

IRONWORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

HEMPEL'S GAS ANALYSIS, $2.25.

SELF-INSTRUCTION FOR STUDENTS IN GAS MANUFACTURE. $1.25.

LIQUID FUEL FOR MECHANICAL AND INDUSTRIAL PURPOSES. By E. A. Brayley Hodgetts. $2.50.

PRACTICAL HANDBOOK ON GAS ENGINES, by G. Lieckfeld. $1.

HEAT A MODE OF MOTION. By John Tyndall. $2.50.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

MANUAL FOR GAS ENGINEERING STUDENTS. By D. Lee. 40 cents.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

TREATISE ON MASONRY CONSTRUCTION. Baker. $5.

GAS ENGINEER'S LABORATORY HANDBOOK. By Jno. Hornby. $2.50.

FINANCES OF GAS AND ELECTRICITY MANUFACTURING ENTERPRISES. By Wm. D. Marks. $1.

PRACTICAL PLUMBING. By P. J. Davies. Vol. I. $3, Vol. II. $4.50.

AMERICAN PLUMBING. By Alfred Revill. $2.

A COMPARISON BETWEEN THE ENGLISH AND FRENCH METHODS OF ASCERTAINING THE ILLUMINATING POWER OF COAL GAS. $1.00.

ELECTRICITY.

INDUSTRIAL PHOTOMETRY, with Special Application to Electric Lighting. By A. Palaz, Sc.D. $4.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Kapp. $3.50.

ELECTRICIAN'S POCKET-BOOK. By Monroe and Jamieson. $2.50.

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By E. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATED WIRES AND CABLES. $1.

ELECTRIC LIGHTING, by Francis B. Crocker. $3.

ELECTRIC LIGHT FITTING. $2.

PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

ELECTRICITY, Its Theory, Sources and Applications. By John T. Sprague. $6.

The above will be forwarded upon receipt of price. If sent by mail or express, postage or express charges must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order. No books sent C.O.D.

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK.

THE HUMPHREY LIGHT is made in its entirety in our own shops.

Our lamp business is not a side issue jobbed out among various brass workers. We are the designers and makers of the original gas arc light.

GENERAL GAS LIGHT CO.,
KALAMAZOO, MICH.

54 Warren Street, New York.
530 Market Street, San Francisco.

FRANK D. MOSES,

Long Distance Telephone, 1922, Trenton, N. J.
TRENTON, N. J.,
Long Distance Telephone, 1922 Trenton, N. J.

Constructing Engineer and Contractor.

Estimates Furnished on any kind of Work in Connection with Gas or Water Plants.

SPECIAL ATTENTION GIVEN TO THE REMODELLING AND EXTENDING OF THE PROPERTIES OF WORKS NOT UP-TO-DATE

CORRESPONDENCE SOLICITED.

ARTHUR R. CRUSE, President. FRANK FLAVELL, Secretary. AARON E. KEMPER, Treasurer.

Cruse-Kemper Company,

PHILADELPHIA OFFICES: Stephen Girard Building. - - WORKS: Ambler, Pa.

Manufacturers of

Triple, Double and Single-Lift Gasholders,

With or Without Metal Tanks,

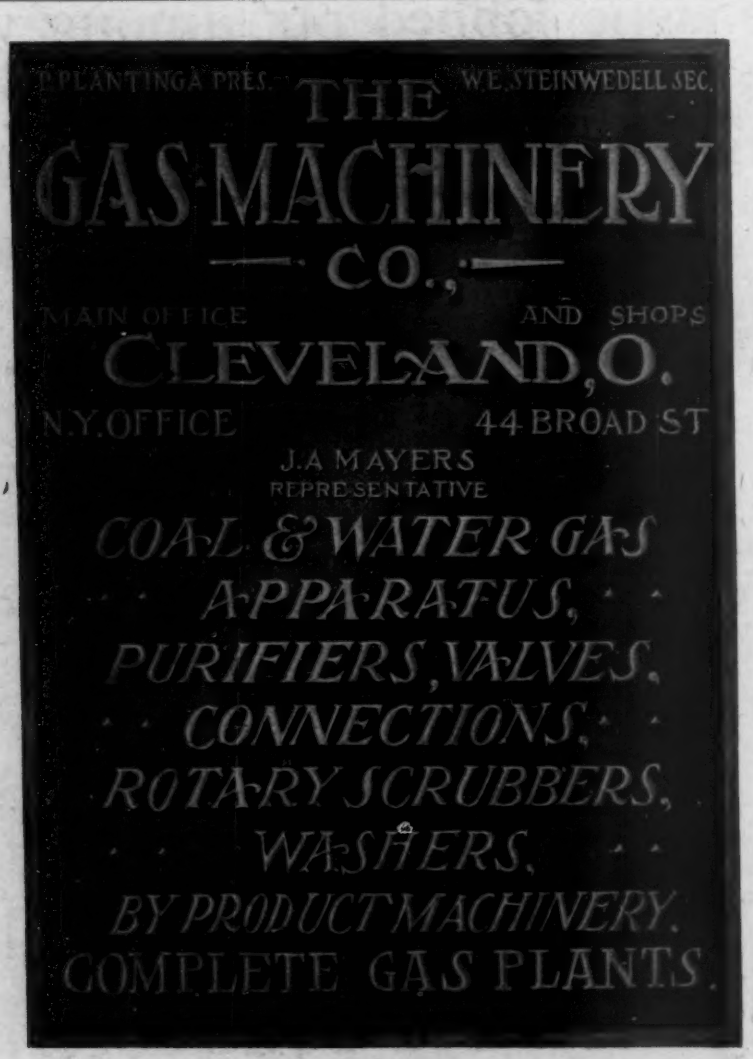
Oil and Water Tanks, Purifier Covers, General Plate Metal Work, and Steel Water Towers.

Plans, Specifications and Estimates Promptly Furnished on Request.

WE DON'T WANT MUCH OF YOUR MONEY.

The amount you spend per year for open-flame illuminating burners is a very small fraction of your total expenditures, and we want only that small fraction; but we want that part of your business very much indeed. **Special Offer.**—To any gas company we will send samples of Steward Lava Tips and Steward Special (union jet) Burners and a sample cake of STAINOFF, free of charge.

D. M. STEWARD MFG. CO., Est. 1876, **CHATTANOOGA, TENN., U. S. A.** 1



PATENTS, TRADE-MARKS, COPYRIGHTS.

ROYAL E. BURNHAM,

Solicitor of Patents and Counsellor in Patent Causes.

833 Bond Building, Washington, D. C.

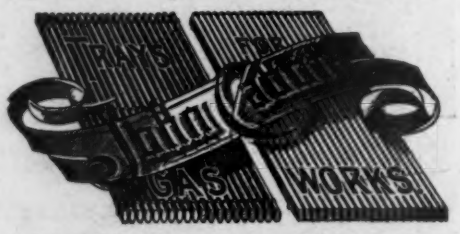
Send for Pamphlet on Patents.

1418 tf

Church's Patent Trays.

Reversible; Strongest; Most Easily Repaired.

Special Trays for Iron Sponge.



1412-1416 Adams Street, Hoboken, N. J.

We also Supply the Chapest and Strongest

•Reversible Bolted Trays•

IN THE MARKET.

SEND FOR BOOKLET AND CIRCULARS.

FIELD'S ANALYSIS FOR THE YEAR 1902.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 34th year of publication. Compiled and arranged by JOHN W. FIELD, Sec'y and Gen. Mgr. of The Gas Light and Coke Company, London. Price, $5. For Sale by

A. M. CALLENDER & CO., 42 Pine St., New York City.

WHY ARE SO MANY GAS COMPANIES USING THE REEVES' ATTACHMENT?

INQUIRE OF THE

REEVES MFG. CO., - New Haven, Conn.

FRED. BREDEL, President. WM. O. VILTER, Vice-President. O. W. GREENSLADE, Secretary and Treasurer.

FRED. BREDEL COMPANY,

ENGINEERS AND BUILDERS OF GAS PLANTS.

Inclined Benches, own system, Recuperative Furnaces, Exhausters, Exhauster Governors, Condensers, Washers, Coolers, Wet Purifying Plants, Purifiers, Oxide Elevators, Hydraulic and Dry Coke Conveyors.

Special High Grade Material for Recuperative Furnaces.

Licensees for ARROLL-FOULIS Charging and Discharging Machines and FRONHAUSER Coke Conveyors. **OFFICE, 405 KEENE ST., MILWAUKEE, WIS.**

BRAY BURNERS

Are Used Everywhere,

Because they are the best.
Reliable absolutely.
Accurately marked.
You can't find a city in the world,
with gas, not using them.

All Bray Burners are stamped with Name and Trade Mark.
Refuse Imitations. Send for Blue Book.

WILLIAM M. CRANE COMPANY,

1131 & 1133 Broadway, New York City.

"THE MINER"

Globe
Street and Boulevard
Lamps.

Cheapest and Best
THOUSANDS IN USE WITH INCANDESCENT BURNERS.
Send for Catalogues.

THOMAS T. W. MINER,
821-823 Eagle Av., N.Y.

Hunt Coal Coke Handling Machinery.

Write for Catalogue.
C. W. HUNT COMPANY,
West New Brighton, N. Y.

THE
Ludlow Valve Mfg. Co.,
TROY, N. Y., U. S. A.
Double and Single Gate Valves, ¼" to 72".
—FOR—
Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.

Elevating and Conveying Outfit installed for Mutual Gas Light Co., New York City, for

Reclaiming Coke From Ashes.

Our experience includes designing and installation of all kinds of conveying machinery which make for economy in the manufacture of gas.

LINK-BELT ENGINEERING COMPANY,
Philadelphia.

NEW YORK: 49 Dey St.
PITTSBURG: Park Bldg.
CHICAGO: Link-Belt Machinery Co.

J. F. W. JOST,

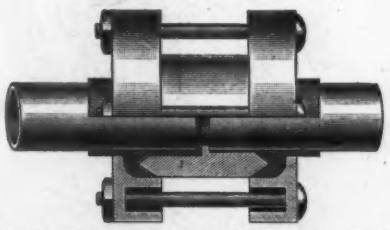
CHEMICAL ENGINEER
—IN—
GAS MANUFACTURE,
P. O. BOX 2043, PHILADELPHIA, PA.

FINANCES OF
Gas and Electricity Manufacturing Enterprises,
By WM. D. MARKS. Price, $1. For Sale by
A. M. Callender & Co.,
42 Pine Street, New York City.

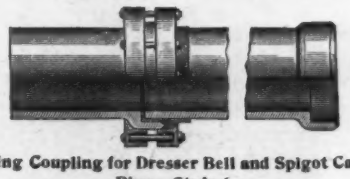
Practical Handbook on
GAS ENGINES,
With Instructions for Care and Working of the Same,
By G. LIECKFELD, C.E.
Translated with Permission of the Author,
By GEO. M. RICHMOND, M.E.
Price, $1. For Sale by
A. M. CALLENDER & CO.,
No. 42 Pine Street, New York City.

S. R. DRESSER,

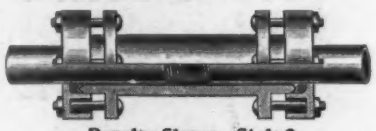
BRADFORD, PENNSYLVANIA, U. S. A.,
Patentee and Manufacturer of Specialties for Oil and Gas Lines.



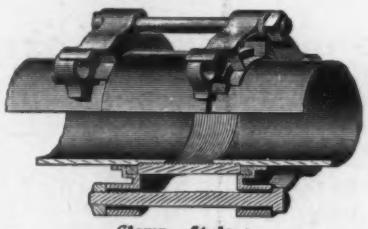
Insulating Coupling for Wrought Iron Pipe. Style 5.



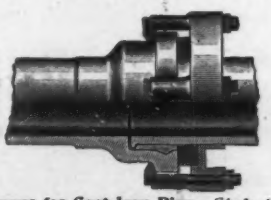
Insulating Coupling for Dresser Bell and Spigot Cast Iron Pipe. Style 6.



Regular Sleeve. Style 2.



Clamp. Style 4.



Clamps for Cast Iron Pipe. Style 4½.

Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

My Insulating Coupling prevents the destruction of pipe by electrolytic action, in either water or gas lines.

SEND FOR CATALOGUE.

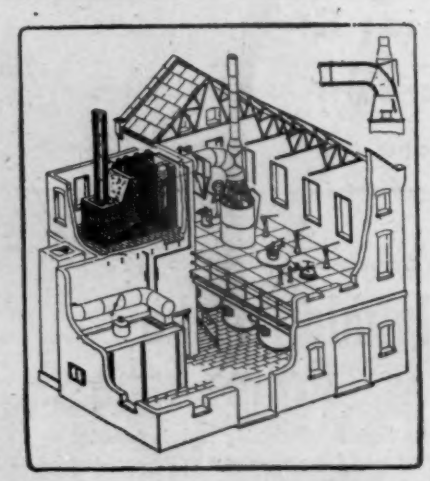
LLOYD CONSTRUCTION COMPANY,
DETROIT, MICH.

GAS WORKS BUILDERS.

Economize Heat in Water Gas Plants,

BY UTILIZING A

Green's Economizer,



To absorb the heat now going to waste when you blow through your superheater to heat the feed water for your boilers to the temperature of the steam. This is now being done at the Poughkeepsie Gas Works, Poughkeepsie, N. Y. : : : : :

Write for full particulars how this is accomplished, the saving effected, and the advantages gained, to the

GREEN FUEL ECONOMIZER CO.,
MATTEAWAN, N. Y.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE.

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,
238 Java Street, Brooklyn, N. Y.

GEORGE R. ROWLAND,
Formerly with the Continental Iron Works.
Draughtsman and Constructing Engineer.

Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.

Office, No. 245 Broadway, N. Y. City.

Bristol's Recording
PRESSURE GAUGE.

For continuous records of **Street Gas Pressure.** Simple in construction, accurate in operation and low in price.

Fully Guaranteed. Send for Circulars.

THE BRISTOL CO.,
Waterbury, Conn.

Silver Medal, Paris Exposition.

Gas Analyses of All Sorts and Conditions,
—OR—
Analyses of Solid and Liquid Materials as Well,

That are needed by Gas Companies at any time in the conduct of their business, may be obtained from

DR. W. H. BIRCHMORE,
1421-tf 341 ADELPHI ST., BROOKLYN, N. Y.

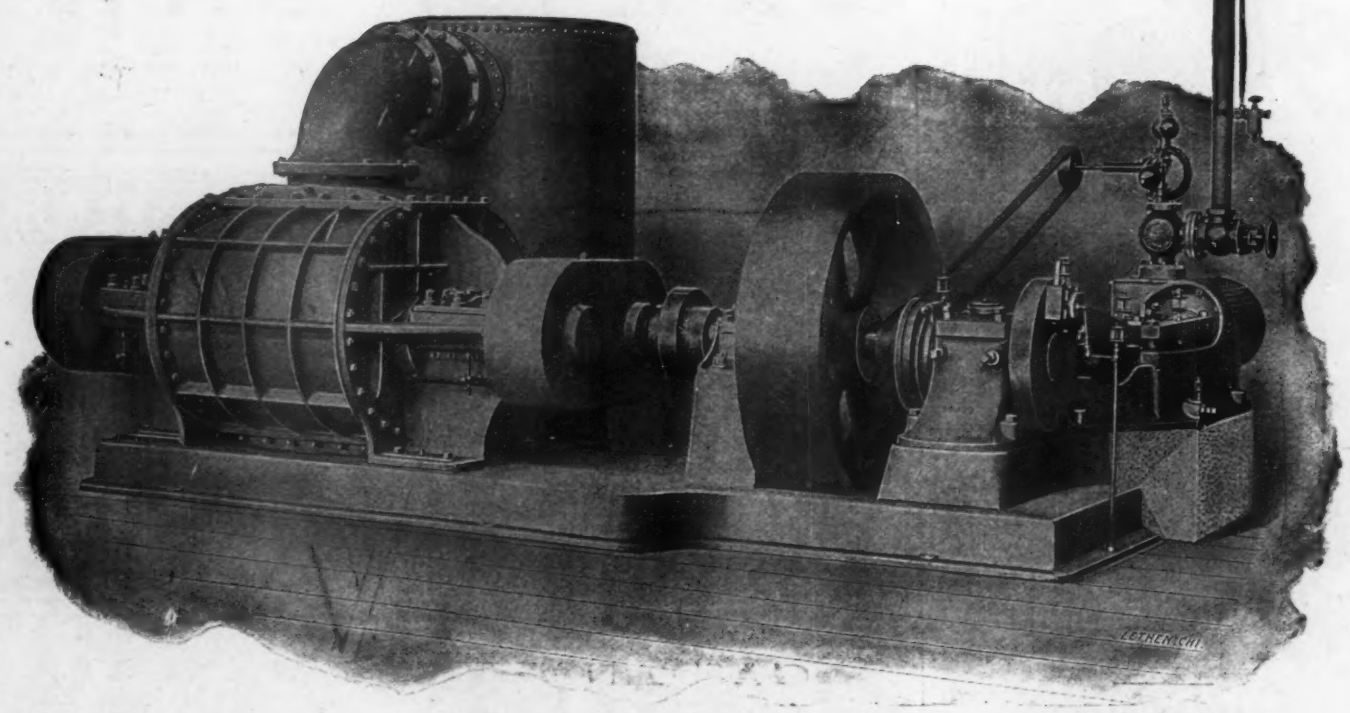
Gas Engineer's Pocket-book, —BY— HENRY O'CONNOR.
Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works. **PRICE, $3.50.** For Sale by
A. M. CALLENDER & CO., 42 Pine St., N.Y. City.

ROOTS'

HORIZONTAL GAS EXHAUSTER.

WE are building a line of Exhausters as per cut herewith, for forcing gas long distances and under pressures that are higher than ordinary pressures.

WE INVITE CORRESPONDENCE.



P. H. & F. M. ROOTS COMPANY,

HOME OFFICE:
Connersville, Ind.

NEW YORK OFFICE:
120-122 Liberty Street.

"Elmorgan" Pipe Fittings

Lead Specials Superior, Etc.

M. J. DRUMMOND & CO.

MANUFACTURERS OF

CAST IRON

FLANGE

GAS and WATER PIPE

GENERAL SALES OFFICE, 192 BROADWAY, NEW YORK.

GEORGE ORMROD, Manag'r. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa.

EMAUS PIPE FOUNDRY

DONALDSON IRON COMPANY. EMAUS, PA.

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES

—FOR—

Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

Send for Circulars.

Geo. Light,
DAYTON, O.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,

Consulting Engineers.

Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::

PLANS, SPECIFICATIONS AND ESTIMATES PREPARED.

AMERICAN OFFICE:
269 Front St., East, Toronto, Canada.

THE

Valuation of Gas, Electricity and Water Works

FOR ASSESSMENT PURPOSES.

THOS. NEWBIGGING, M.Inst.C.E., and WM. NEWBIGGING, Assoc.M.Inst.C.E.

With an Appendix of Decided Cases.

Second Edition. Price $2. For Sale by
A. M. CALLENDER & CO.,
42 Pine Street, N. Y. City.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

SAFETY GAS MAIN STOPPER COMPANY,

For Shutting Off Gas in Mains

Any size gas main can be shut off in 30 seconds. : : :

Temporarily during alterations and repairs. : : : :

STOPPERS SENT ON TRIAL.

Address: SAFETY GAS MAIN STOPPER CO., 108 E. 117th St., New York City.

FOX HILL FOUNDRY,

F. FERGUSON & SON,

HOBOKEN, N. J.

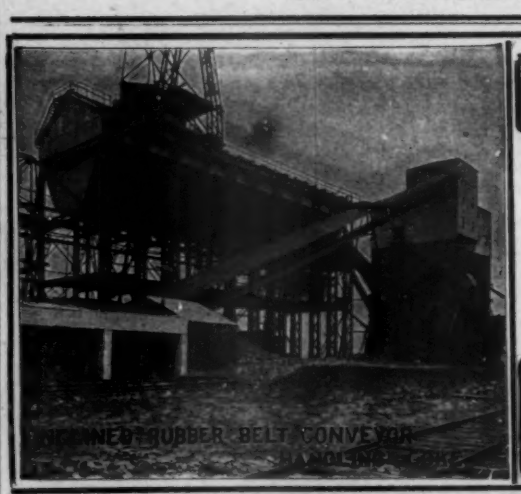
FINE OPENING

GRATE BARS

FOR GAS WORKS.

STATIONARY, SHAKING, DUMPING.

BARS FOR HAZELTON BOILERS.



BELT CONVEYORS

EQUIPPED WITH

BALL BEARING ROLLS

ARE THE BEST,

because they possess greater efficiency, consume less power, and the belts last longer than when any other type of roll is employed.

PLANS AND ESTIMATES FURNISHED ON REQUEST.

The Link-Belt Machinery Co.

Link-Belt Engineering Co. Philadelphia Chicago, U.S.A.

GAS ANALYST'S MANUAL,

By JAQUES ABADY, M. Inst. Mech. E.

(Incorporating F. W. Hartley's "Gas Analyst's Manual" and "Gas Measurement.")

Ninety-three Illustrations and Nine Folding Plates. Bound in Handsome Half Leather. Price, $6.50.

For Sale by **A. M. CALLENDER & Co., 42 Pine St., New York City.**

ELECTRIC GAS LIGHTING.

How to install electric gas igniting apparatus, including the jump spark and multiple systems for use in houses, churches, theaters, halls, schools, stores or any large building. Also, the care and selection of suitable batteries, wiring and repairs.

By H. S. NORRIE.

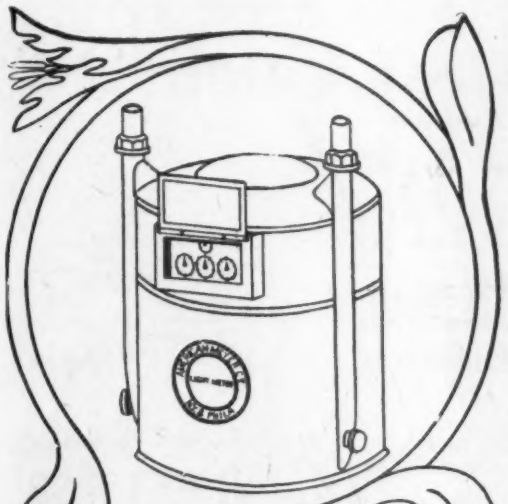
Price, 50 Cents. Orders may be sent to
A. M. CALLENDER & CO., - - - 42 PINE STREET, NEW YORK CITY.

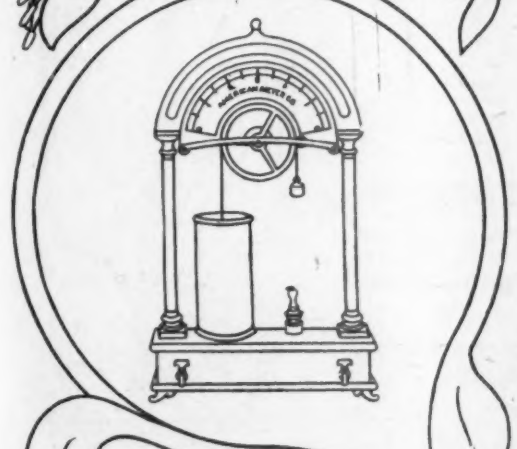
(Copyrighted, 1894, by the AMERICAN METER CO.)

AMERICAN METER CO.

ESTABLISHED 1836. INCORPORATED 1863.

NEW YORK,
PHILADELPHIA,
CHICAGO,
ST. LOUIS,
SAN FRANCISCO.

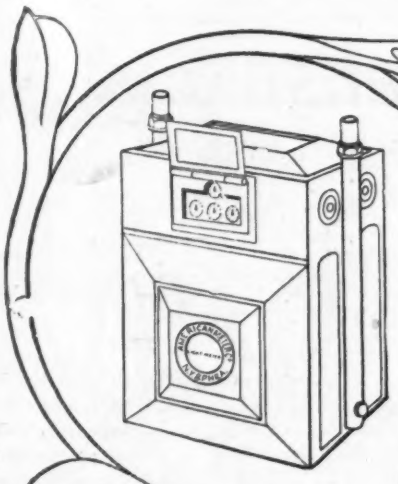


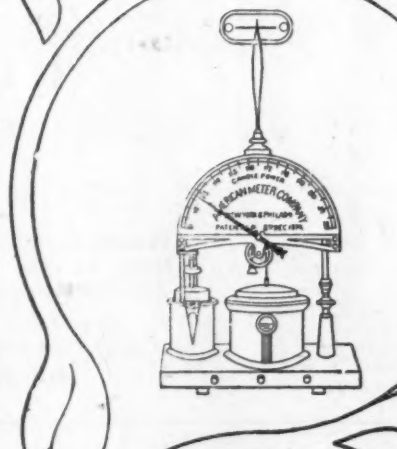


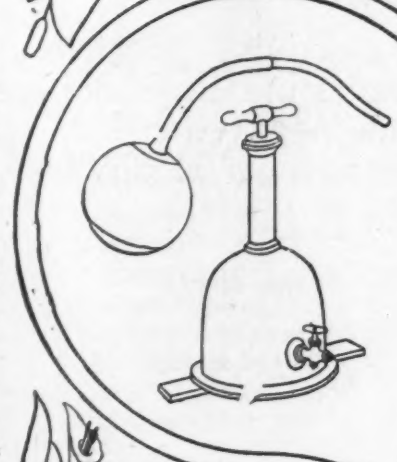
PUBLIC LIGHTING TABLE.

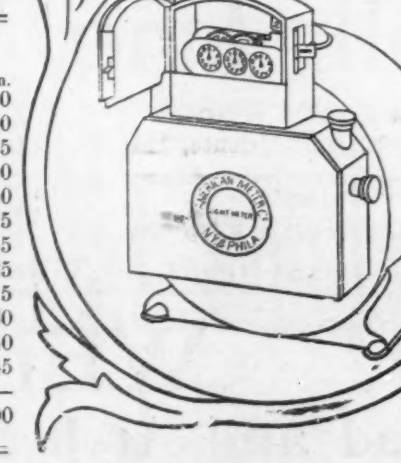
JULY, 1904.

Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light.	Extinguish.
				P.M	A.M.
Fri.	1	8.00 PM	10.50 PM	7.30	3.15
Sat.	2	8.00	11.20	7.30	3.15
Sun.	3	8.00	11.50	7.30	3.15
Mon.	4	8.00	12.20 AM	7.30	3.15
Tue.	5	8.00 LQ	12.50	7.30	3.15
Wed.	6	8.00	1.20	7.30	3.15
Thu.	7	8.00	2.00	7.30	3.15
Fri.	8	8.00	2.40	7.30	3.15
Sat.	9	8.00	3.40	7.30	3.15
Sun.	10	8.00	3.40	7.30	3.15
Mon.	11	8.00	3.40	7.30	3.15
Tue.	12	8.00 NM	3.40	7.30	3.15
Wed.	13	8.00	3.40	7.30	3.15
Thu.	14	8.00	3.40	7.30	3.15
Fri.	15	8.00	3.40	7.30	3.15
Sat.	16	8.00	3.40	7.20	3.15
Sun	17	9.30	3.50	7.20	3.15
Mon.	18	10.00	3.50	7.20	3.15
Tue.	19	10.40 FQ	3.50	7.20	3.15
Wed.	20	11.20	3.50	7.20	3.15
Thu.	21	12.00	3.50	7.20	3.15
Fri.	22	12.40 AM	3.50	7.20	3.15
Sat.	23	1.30	3.50	7.20	3.15
Sun.	24	2.20	3.50	7.20	3.15
Mon.	25	No L.	No L.	7.20	3.15
Tue.	26	No L. FM	No L.	7.20	3.15
Wed.	27	No L.	No L.	7.20	3.15
Thu.	28	7.50 PM	8.50 PM	7.20	3.15
Fri.	29	7.50	9.30	7.20	3.15
Sat.	30	7.50	10.00	7.10	3.30
Sun.	31	7.40	10.30	7.10	3.30









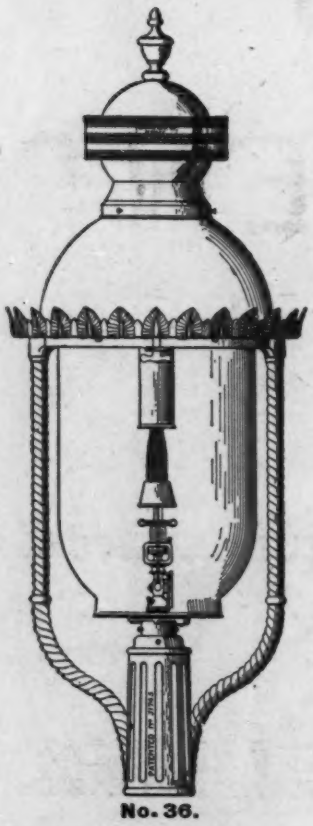
TOTAL HOURS LIGHTING DURING 1904.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	225.00	January	423.20
February	205.40	February	367.40
March	187.40	March	355.35
April	169.50	April	298.50
May	152.30	May	264.50
June	137.20	June	234.25
July	138.50	July	243.45
August	151.00	August	280.25
September	164.40	September	321.15
October	191.30	October	374.30
November	210.30	November	401.40
December	237.10	December	433.45
Total, yr.	2171.40	Total, yr.	4000.00

NEW YORK, 97 Liberty Street. BOSTON, 814 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, Foot of Orleans Street. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

AN underlying principle in business is to show an increase each year---to grow. The astute dealer not only seeks to retain this year's customers, but to attract new trade next year.

The formula is simple-

THIS SHIELD IS THE WELSBACH TRADE MARK.

IT IS A GUARANTEE AND A PROTECTION.

Sell The Welsbach Brands.

The imitation stuff is bad for the customer---which is bad for you.

The genuine Welsbachs---Burners or Mantles---make satisfied customers---keep customers---MAKE NEW ONES.

And your profit isn't merely dollars and cents.

WELSBACH CO.,

Broad and Arch Sts., PHILADELPHIA.

THE UNITED GAS IMPROVEMENT COMPANY

For the Year Ending December 31, 1903. has been Awarded Contracts in the Following Places for

Standard Double-Superheater Lowe Water Gas Apparatus.

Rochester, N. Y.	Chester, Pa.	Savannah, Ga.
Baltimore, Md.	Lynn, Mass.	New York (Central Union Co.)
Chicago, Ills.	Newark, N. J.	Cicero, Ills.
Amesbury, Mass.	Washington, D. C.	Chicago (Ogden Co.)
Aberdeen, S. D.	Boone, Ia.	Easton, Pa.
Winsted, Conn.	Pueblo, Col.	Lawrence, Mass.
Canon City, Col.	Charlotte, N. C.	Council Bluffs, Ia.
Schenectady, N. Y.	Fall River, Mass.	Chattanooga, Tenn.
Hagerstown, Md.	Duluth, Minn.	Tuckerton, N. J.
Malden, Mass.	New York (Mutual Co.)	Springfield, O.
Bridgeport, Conn.	Waltham, Mass.	Easton, Pa. (2d contract).
Albert Lea, Minn.	Dover, Del.	Mobile, Ala.
Brooklyn, N. Y.	York, Pa.	Conshohocken, Pa.
Kansas City, Kas.	Minneapolis, Minn.	Mason City, Ia.
Hempstead, N. Y.	Allentown, Pa.	

TOTAL SETS FOR 1903, ... 62
TOTAL DAILY CAPACITY, ... 62,950,000 cubic feet.
TOTAL SETS TO DATE, ... 508
TOTAL DAILY CAPACITY, ... 362,780,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES, FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

OFFICE AND WORKS:
88 VAN DYKE ST., BROOKLYN, N. Y.
MANUFACTURERS OF

CLAY GAS RETORTS & SETTINGS, GENERATOR LININGS. SPECIALTIES.

Established 1854. Incorporated 1869.

LACLEDE
Fire Brick Manufg. Co.,

Manufacturers of { GAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Proprietors for the U. S., Coze System of Inclined Benches.

Estimates Furnished on Application for Most Successful Style of Construction.

Also for Free-Firing and Full and Half-Depth Regenerative Benches, for Burning either Coal or Coke in the Furnaces.

Office:
Cor. Manchester and Sulphur Avenues, **St. Louis, Mo.**

Established 1845. Reorganized 1902.

The Kreischer Brick Mfg. Co.,

Manufacturers of the very best quality of Clay Retorts, Blocks, Tiles, Settings and Firebrick of every description.

Also Miners and Shippers of Fireclay, Fire Sand, Ground Brick in Barrels.

WORKS: KREISCHERVILLE, STATEN ISLAND.
OFFICE: 119 E. 23D STREET, NEW YORK CITY.

Adam Weber Sons.

WORKS: Weber, N. J.

GENERAL OFFICE: Park Row Bldg., N. Y. City.

DEPOT AND YARD: 639 E. 15th St., N. Y. City.

ERECTION OF

Modern Coal Gas Plant,

With either Horizontal, Inclined or Vertical Retorts.

PATENTS APPLIED FOR.

No. 1. Firing horizontal benches with pulverized fuel, with either 8 or 10 retorts in 1 setting, using one furnace for two benches. Great saving in labor, fuel and life of retorts and settings. No elaboration of complex recuperation.

No. 2. Independent retort settings, taking all weight from retorts.

No. 3. Vertical retorts with vertical charge and discharge. Sixteen retorts in one bench.

MODERN IRONWORK.

ISAAC C. BAXTER, President.
Works, LOCKPORT STATION, PA.

ESTABLISHED 1864.

JAMES GARDNER, JR., CO.,

Successor to WILLIAM GARDNER & SON.

PETER YOUNG, Sec'y and Treas.
Address all communications to JAMES GARDNER, JR., CO., Room 202 Lewis B'l'dg. PITTSBURGH, PA.

Fire Clay Goods for Gas Works.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 423 East 23d St., N. Y.

Clay Gas Retorts,
BENCH SETTINGS,
Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. BLOOMINGTON, INDIANA.
In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD, BLOOMINGTON, IND.

For orders East of Buffalo, N. Y., or Pittsburg, Pa., freight will be paid to these points.

The Gas Engineer's Pocket-Book,

By HENRY O'CONNOR.

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

PRICE, $3.50.

For Sale by

A. M. CALLENDER & CO., 42 Pine Street, New York City.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE
RETORT & FIRE BRICK CO.

MANUFACTORY AT
LOCUST POINT, BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY, AND FIRE CEMENT.

Our Improved Half and Full Depth Benches have been Adopted by Many Gas Companies.

WALDO BROS., 102 MILK ST., BOSTON, MASS.

Sole Agents for New England States.

JOHN DELL,
President and General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

MANUFACTURERS OF

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are the **Exclusive Agents** *for the* **Mitchell Patent Benches,** *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* **Rear Clinkering.** **The Mitchell** *is the* **Original Coal Firing Bench.** *We also Erect Plain Benches with* **One** *to* **Six Retorts.**

YOUR CORRESPONDENCE IS RESPECTFULLY SOLICITED.

City Office: *411 Olive Street, Continental Bank,* ST. LOUIS, MO.

Bronder Patent Stoking Machinery.

Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y. Toronto and Montreal, Canada.

Four-Scoop and Four-Rake Charging and Discharging Machines are being furnished for Detroit, Mich.

These are the only machines that will draw or charge simultaneously three or four retorts (vertically) and handle from 42 to 60 retorts in from 25 to 30 minutes, lid opening and closing and filling of furnaces included.

Hot Coke Conveyor, Quencher and Steam Exhauster, operating in Toronto, Can., working in water-sealed flue, rollers being protected from heat and grit.

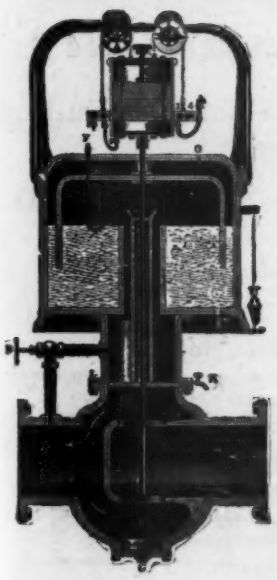
COAL CRUSHERS, CONVEYORS AND BINS. TURNTABLES FOR MACHINES.

Labor-Saving Machines for Handling Coal and Coke from Coal Cars to Coke Yard or Bins, a Specialty.

G. A. BRONDER,
Contracting Engineer and Builder,
229 BROADWAY, NEW YORK.

CONNELLY IRON SPONGE AND GOVERNOR CO.,

CONSTRUCTORS OF



Coal Gas Apparatus.

Automatic, Balance and Service Gas Governors.
Roots Improved Gas Exhausters.
Iron Sponge for Gas Purification.
Jones Jet Photometers, Pressure Registers, etc.

GAS SPECIALTIES.

395 Broadway, New York. 788 South Canal St., Chicago, Ills.

PRACTICAL PHOTOMETRY,

By WILLIAM JOSEPH DIBDIN,

PRICE, $3. FOR SALE BY

A. M. CALLENDER & CO., 42 Pine Street, New York City.

The Gas Engineer's Laboratory Handbook,

By JOHN HORNBY, F.I.C.

Price, $2.50.

A. M. CALLENDER & CO., 42 Pine St., N. Y. City.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING:

Ocean Mine Youghiogheny Gas Coal,
Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK, PHILADELPHIA, BALTIMORE AND NORFOLK.

BERWIND-WHITE COAL MINING COMPANY'S

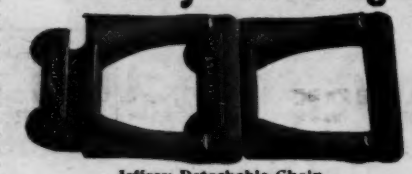
Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully Prepared.
For Gas Making or
Heavy Steaming. .

A. C. M. AZOY, General Agent, 1 Broadway, New York.

Jeffrey Elevating-Conveying Machinery



Jeffrey Detachable Chain.

FOR HANDLING

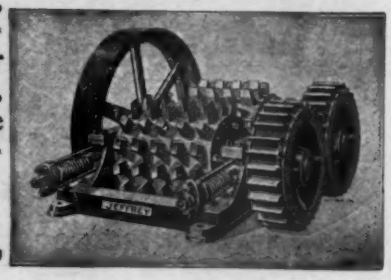
COAL, COKE, ETC.

MAY WE SEND YOU COPY OF OUR CATALOGUE NO. 72

Shaking Screens, Dump Cars, Power Transmission Machinery, Chains, Elevator Buckets, Sprocket Wheels, Crushers, Screens, Cable Conveyors, Spiral Conveyors, Etc.

ADDRESS

THE JEFFREY MFG. COMPANY,
COLUMBUS, OHIO, U. S. A.
NEW YORK : : : CHICAGO : : : DENVER.



Coal and Coke Crushers.

The Gas Engineer's Laboratory Handbook,

By JOHN HORNBY, F.I.C. Price, $3.50.

Orders may be sent to

A. M. CALLENDER & CO., 42 Pine St., N. Y.

COAL TAR
— AND —
AMMONIA.

Third and Enlarged Edition.

BY

GEORGE LUNGE, Ph.D.

Price, $15. For Sale by

A. M. CALLENDER & CO.,
42 Pine Street, New York City.

SELF-INSTRUCTION

For Students in Gas Manufacture.

Price, $1.25. For Sale by

A. M. Callender & Co.,
42 Pine Street, New York City.

ELECTRIC GAS LIGHTING.

How to install electric gas igniting apparatus, including the jump spark and multiple systems for use in houses, churches, theaters, halls, schools, stores or any large building. Also, the care and selection of suitable batteries, wiring and repairs.

By H. S. NORRIE.

Price, 50 cents. Orders may be sent to

A. M. CALLENDER & CO., 42 PINE ST., N. Y. CITY.

KELLER ADJUSTABLE COKE CRUSHER

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER
Sec. & Supt. Gas Lt. & Coke Co
Columbus, Ind.
Correspondence Solicited.

Do You Wish to Know

what size of pipe to use to convey any quantity of gas, any distance, with any loss of pressure and any initial or final pressure? Then us

Cox's Gas Flow Computer,

as it gives this information accurately at sight without mental effort. No calculations needed Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50.
For sale by
A. M. Callender & Co., 42 Pine St., N. Y.

POOLE ON FUELS.

THE CALORIFIC POWER OF FUELS.

By HERMAN POOLE, F.C.S.

Second Edition. Price, $3. For Sale by
A. M. CALLENDER & CO., 42 Pine St., N.Y. City.

BINDER for the JOURNAL.

Price, $1.00.

A. M. CALLENDER & CO., 42 Pine Street, N.Y.

Edmund H. McCullough, President. Chas. F. Godshall, Treasurer. H. C. Adams, Secretary. Henry Wharton, Assistant Secretary.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.,
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

SUN COMPANY,

PRODUCER, REFINER, SHIPPER AND EXPORTER OF
Petroleum and All Its Products.

Pittsburg, Pa., and Philadelphia, Pa.

THE SUN OIL CO.

Gas Oil, Gas Naphtha,
Refined Oil, Lubricating Oils.

Toledo, O., and Pittsburg, Pa.

BROWNHOIST POWER TRAMRAIL

SYSTEMS FOR HANDLING MATERIAL IN GAS HOUSES.

The Brown Hoisting Machinery Co.,

New York. Cleveland. Pittsburg.

PRACTICAL HANDBOOK ON

GAS ENGINES,

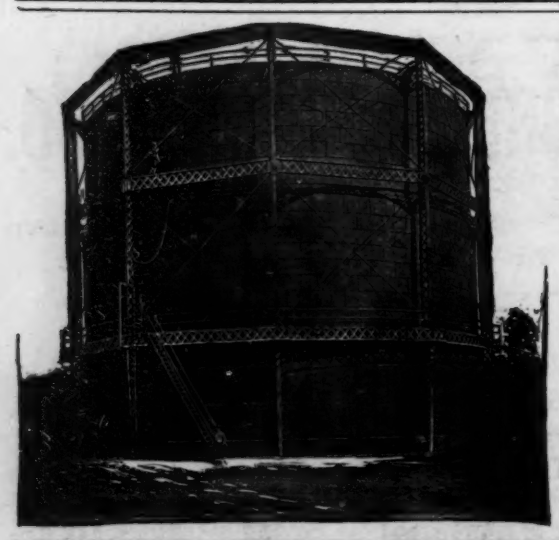
With Instructions for Care and Working of the Same.

By G. LIECKFELD, C.E.

Translated with Permission of the Author, by GEO. M. RICHMOND, M.E.

PRICE, $1.00.

A. M. CALLENDER & CO., 42 Pine Street, New York City.



DAVIS & FARNUM MFG. CO.,

WALTHAM, MASS.

Principal Office & Works, Waltham, Mass. Boston Office, R'm 18, Vulcan Bldg., 8 Oliver St.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

BAXTER & YOUNG,

CONTRACTING AND CONSULTING GAS ENGINEERS.

Examination and Values Ascertained of Artificial and Natural Gas Properties.

COMPLETE GAS WORKS ERECTED.

Artificial and Natural Gas Mains Furnished and Laid.

GAS PROPERTIES PURCHASED.

OFFICE: WAYNE COUNTY BANK BUILDING,

Rooms 201 & 202. DETROIT, MICH.

A. E. BOARDMAN, C. E.,

Consulting and Contracting Engineer.

Particular attention given to Gas, Water and Electric Plants. Long and successful experience with the problem and practice of

Filtration for Public Water Supply.

Edison Building, 42 and 44 Broad St.,

NEW YORK CITY.

DAVID LEAVITT HOUGH,

Consulting Engineer

AND

CONTRACTOR,

PARK ROW BUILDING, N. Y.

Geo. Shepard Page's Sons.

GAS MACHINERY.

Correspondence Solicited.

180 Fulton Street, New York City.

Established 1876.

National Paint Works.

PAINTS FOR METAL SURFACES.

We Sell 65 Per Cent. of the Gasholder Paint in the United States.

SALES OFFICE:	FACTORY:	SALES OFFICE:
Great Northern Bldg., Chicago.	Williamsport, Pa.	92 William Street, New York City.

KERR MURRAY MANUFACTURING COMPANY,

Engineers and Manufacturers

APPARATUS FOR COAL GAS PLANTS,

SINGLE AND DOUBLE-LIFT GASHOLDERS AND STEEL TANKS,

Latest Improved

ROTARY EXHAUSTERS, P. & A. TAR EXTRACTORS, AMMONIA WASHERS,

CONDENSING, SCRUBBING AND PURIFYING APPARATUS.

Street Specials and Valves.

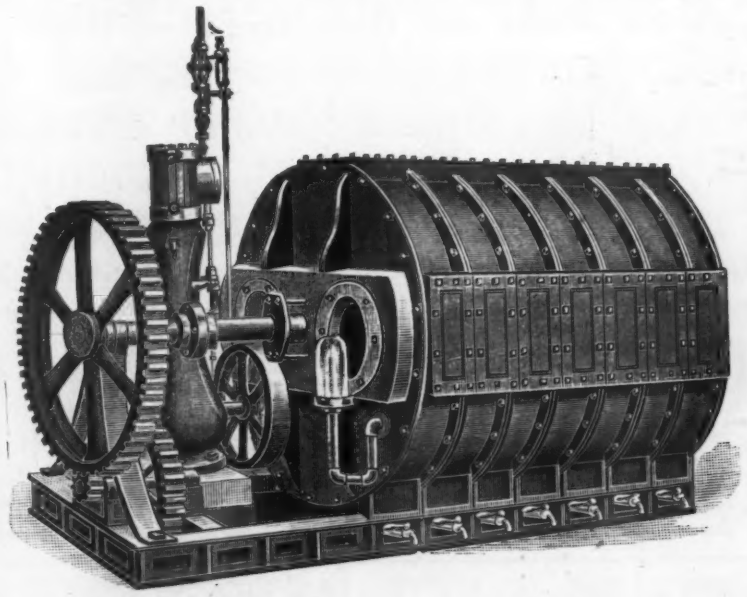
ADDRESS:

KERR MURRAY MANUFACTURING COMPANY, {FORT WAYNE, IND.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Designers and Builders of Gas Works.



Sole Lessees the Wilkinson Water Gas Process.

PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Discs, thus reducing the weight on shaft and power for operating same.

Coal and Water Gas Installations of the Most Modern and Complete Types.

BENCHES WITH INCLINED RETORTS.

System Stettiner Chamotte Fabrik, Actien Gesellschaft, of Stettin, Germany.

GASHOLDERS OF ALL SIZES.

General Western Agents, THE LLOYD CONSTRUCTION CO., of Detroit, Mich.

QUINTARD IRON WORKS,

N. F. PALMER,

Foot of 12th St. & East River, New York,

MANUFACTURERS OF

GAS APPARATUS.

Complete Works Erected.

FREDERICK W. FLOYD, Engineer.

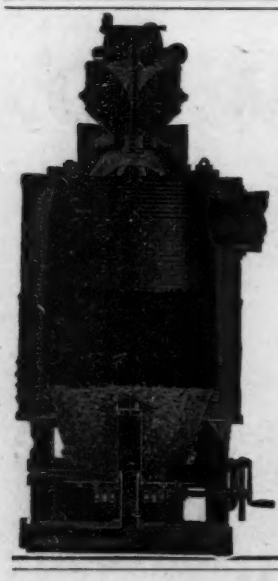
ALEX. C. HUMPHREYS, M.E., M. Inst. C.E. ARTHUR G. GLASGOW, M. E., M. Inst. C. E.

HUMPHREYS & GLASGOW,

BANK OF COMMERCE BLDG., 31 Nassau Street, New York.

38 VICTORIA STREET, London S.W., England.

CONSULTING GAS AND ELECTRIC LIGHT ENGINEERS.
PROPERTIES PURCHASED.
COMPLETE EXAMINATIONS MADE.



R. D. WOOD & CO.,

400 CHESTNUT STREET, PHILADELPHIA,

—BUILDERS OF—

Gas Power Plants with Producers,

The best Producers for either Bituminous, Anthracite Coal or Lignite. Less labor required and less waste than in any other Producer. Send for Pamphlet. : : : :

CAST IRON PIPE.

HYDRAULIC TOOLS. HYDRAULIC OPERATING VALVES.

ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

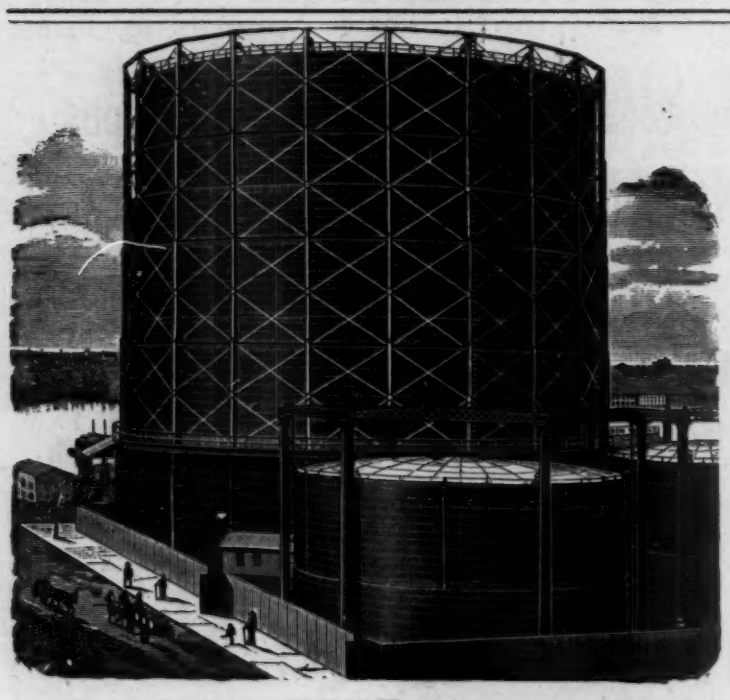
TOTAL ROTARY AMMONIA SCRUBBERS SOLD,

98,806,000 Cu. Feet Daily Capacity.

TOTAL WALKER TYPE TAR EXTRACTORS SOLD,

34,900,000 Cu. Feet Daily Capacity.

OFFICE AND WORKS: Bridge and Ogden Streets, Newark, N. J.



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

West and Calyer Sts. (Near 10th & 23d St. Ferries)
NEW YORK, Borough of Brooklyn.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

STEEL GAS HOLDER TANKS.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

THE GAS ENGINEER'S LABORATORY HANDBOOK,

By JOHN HORNBY, F.I.C.

PRICE, - - - - - - - $2.50.

A. M. CALLENDER & CO., No. 42 Pine Street, New York City

THE STACEY MANUFACTURING COMPANY,

MANUFACTURERS AND BUILDERS OF

GASHOLDERS AND STEEL TANKS

AND ALL IRONWORK AND MACHINERY REQUIRED IN A GAS PLANT.

Also Oil Storage Tanks, Steel Roofs, Stand Pipes, Etc.

We also manufacture Lamp Posts, Gas Valves, all size and shape Castings, Etc.

The only authorized manufacturers of "THE CHOLLAR SYSTEM OF GAS PURIFICATION."

Plans, Specifications and Estimates Cheerfully Furnished on Request.

GENERAL OFFICES:

No. 239 Mill Street, CINCINNATI, OHIO. 'Phone, West 690.

EASTERN SALES AGENT:

FRANK D. MOSES, 7 North Stockton Street, TRENTON, N. J.

RITER-CONLEY MFG. CO.,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. EASTERN OFFICE: 39-41 Cortlandt St., New York City.

WM. HENRY WHITE,

EDISON BUILDING, No. 44 BROAD STREET, = = = NEW YORK CITY,

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

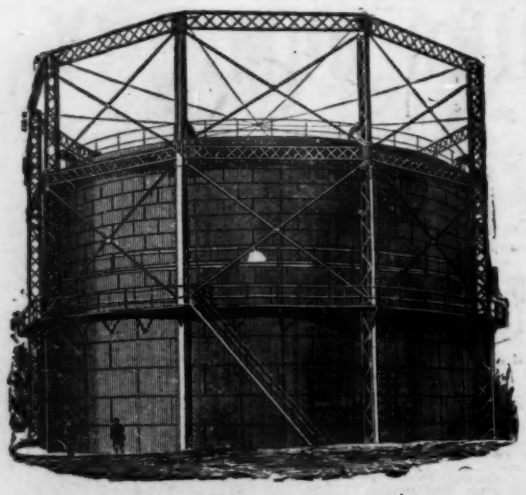
Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited.
Plans and Estimates Furnished.

1903 DIRECTORY 1903

OF AMERICAN GAS COMPANIES.

Price, - - - - - - - - - $5.00.

A. M. CALLENDER & CO., - - No. 42 Pine Street, New York.



1842 ※ Deily & Fowler, ※ 1904

LAUREL IRON WORKS.

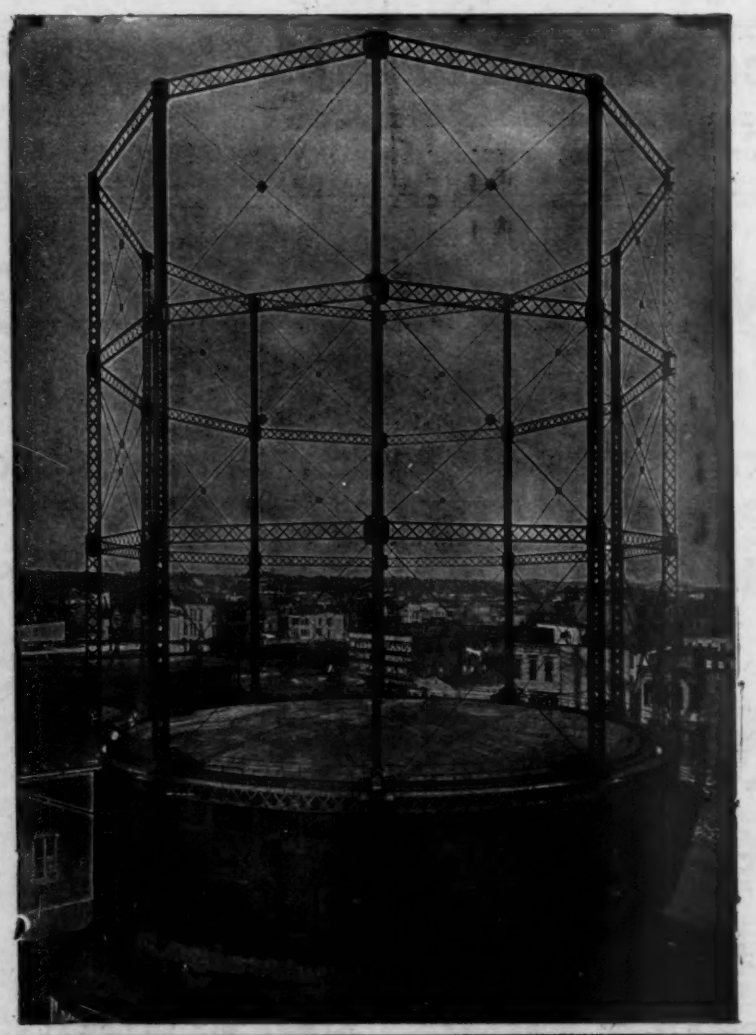
Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.



The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 Cu. Ft.

LOGAN IRON WORKS,

Brooklyn, N. Y.,

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

Complete, with Steel Tanks.

BENCHES, SCRUBBERS,
CONDENSERS,
PURIFIERS, IRON ROOFS,

AND ALL PARTS OF

GAS WORKS APPARATUS.

Contractors for
Complete Works.

Gas Analyst's Manual,

By JAQUES ABADY, M. Inst. Mech. E.

(Incorporating F. W. Hartley's "Gas Analyst's Manual" and "Gas Measurement.")

Ninety-three Illustrations and Nine Folding Plates.
Bound in Handsome Half Leather. Price, - $6.50.

FOR SALE BY

A. M. CALLENDER & CO., - - 42 Pine Street, New York City.

Established 1854.

D. McDONALD & CO.,

MANUFACTURERS OF

WET AND DRY METERS, STATION METERS AND METER PROVERS.

ALSO MAKERS OF

THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

WE HAVE MADE AND SOLD IN THE UNITED STATES

OVER 120,000 OF THESE METERS,

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

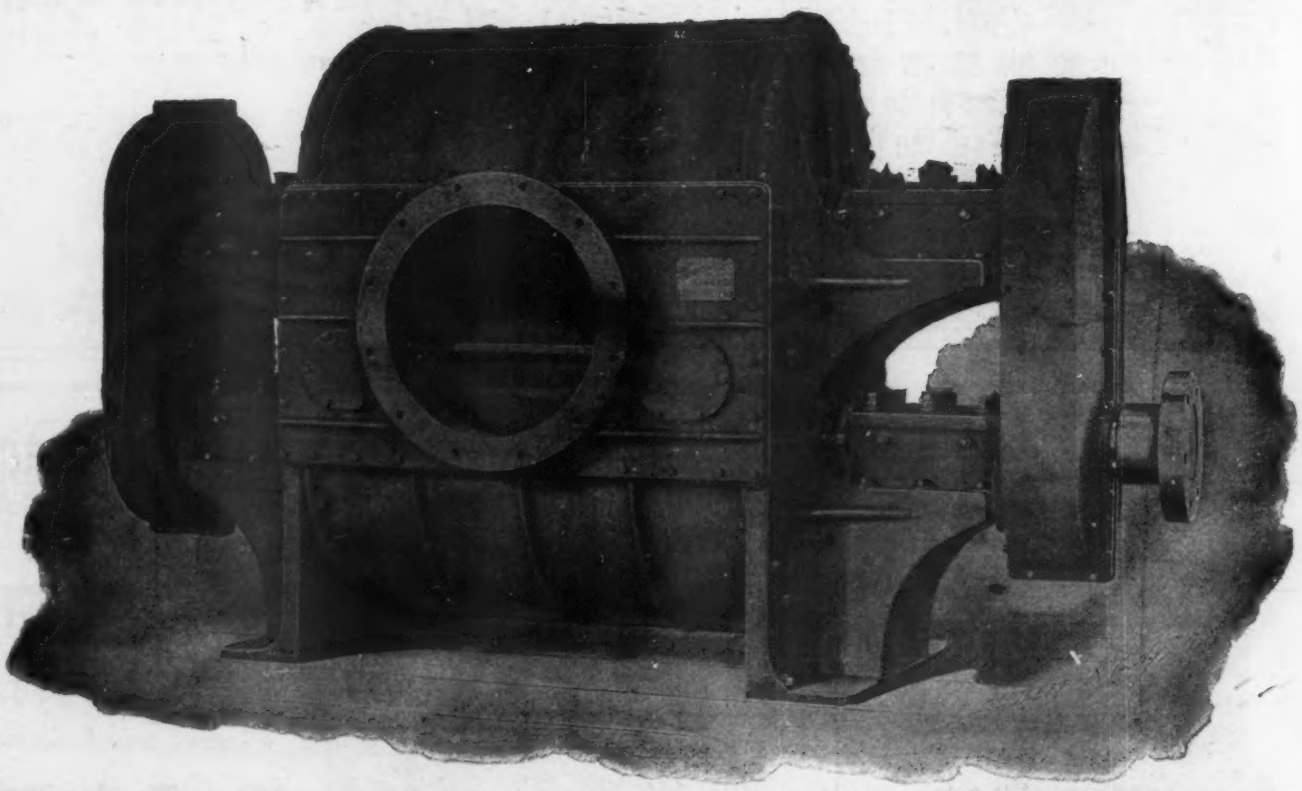
Correspondence Solicited.

561 West Forty-seventh Street, NEW YORK. | 51, 53 & 55 Lancaster Street, ALBANY, N. Y. | Jefferson and Monroe Streets, CHICAGO.

THE CONNERSVILLE BLOWER CO.,

MANUFACTURER OF

ROTARY POSITIVE PRESSURE GAS EXHAUSTERS, BLOWERS AND PUMPS.



HORIZONTAL OR VERTICAL, IN CAPACITY RANGING FROM 9,000 to 1,800,000 CU. FEET DISPLACEMENT PER HOUR.

CONNERSVILLE BLOWER CO., Connersville, Ind. EASTERN SALES OFFICE: 95-97 Liberty St., New York City.

We Have Sold Over 50,000 of Our

PREPAYMENT GAS METERS

IN NEW ENGLAND.

We Have Fitted Up Over 10,000 Idle Regular Meters with Our

PREPAYMENT ATTACHMENT.

Can be Attached to Any Make of Meter.

NATHANIEL TUFTS METER COMPANY, 8 MEDFORD STREET, BOSTON, MASS.

MARYLAND METER CO.,

BALTIMORE, North and Saratoga Streets. CHICAGO, 88 to 92 Jackson Boulevard.

CONSUMERS' AND STATION METERS, PRESSURE GAUGES, ETC.

SPECIAL ATTENTION GIVEN TO ALL REPAIR WORK.

"Have you Seen our Complaint Meter?"

THE PREPAYMENT.

We offer a thoroughly first-class prepayment meter.
We will fit our Reeves Attachments to your regular meters, repairing them at the same time if necessary.
We will sell you the Attachments, and you can put them on.
Which will you have?

KEYSTONE METER CO., Royersford, Pa.

DETROIT STOVE WORKS

"Largest Stove Plant in the World"

MANUFACTURES AND SELLS

DETROIT JEWEL GAS APPLIANCES

FOR COOKING and HEATING,

All about which is told in a fine and strictly "to-the-point" catalog, sent upon request to Gas Companies.

DETROIT, MICH. CHICAGO, ILLS.

AMERICAN METER COMPANY,

NEW YORK, PHILADELPHIA, CHICAGO.
SAN FRANCISCO, ST. LOUIS.

PREPAYMENT METERS.

THEIR CONSTRUCTION IS SUCH THAT THEY MAY BE READILY READJUSTED WHEN THE SCALE OF GAS RATES IS CHANGED.

HELME & McILHENNY,

Established 1848. **1339 to 1349 Cherry Street, Philadelphia, Pa.**

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED.

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

FACTORY AT ERIE, PA.

EXCERPTS FROM DECISIONS

—OF THE—

BOARD OF GAS COMMISSIONERS of the COMMONWEALTH OF MASSACHUSETTS.

MR. E. H. YORKE, NEW HAVEN, CONN., Dec. 1, 1898.

Dear Sir:—I am in receipt of a copy of "Excerpts from the Decisions of the Board of Gas Commissioners," which is a handy compilation in book form of extracts from the most recent decisions of the Gas Commission of Massachusetts.

I note that most of these extracts are broad and safe-guiding precepts, which apply with equal force to one Company as to another. The 13 years' existence of the Board of Gas Commissioners with its unusual opportunities for acquiring information, have justly made it a high and safe authority in all matters pertaining to the management, obligations, and rights of Gas Companies. Your little book will serve as a valuable reference library in settling legal complications which often arise between a Gas Company and its customers.

Yours truly, (Signed) F. C. SHERMAN, Superintendent.

A 28-page Pamphlet containing the cream of this Board's decisions as to the proper management of Gas Companies.

Compiled by E. H. YORKE. Price $1.00. Address

A. M. CALLENDER & CO., - No. 42 Pine Street, New York.

JOHN J. GRIFFIN & CO.,

1513 TO 1521 RACE STREET,

559 West 47th Street, NEW YORK.

PHILADELPHIA.

Jefferson and Monroe Streets, CHICAGO.

MANUFACTURERS OF

GAS METERS,

Station Meters and Experimental Apparatus of Every Description.

PROMPT ATTENTION GIVEN TO ALL REPAIRING.

OUR SPECIAL NATURAL GAS METER

Is the Best ever offered. Over 75,000 now in use.

The Positive Prepayment Meter.

Positive Advantages:

The Income is Quick and Sure.

IT IS

Better than C.O.D.,

As Gas is Paid for Before Delivery. : : :

There is Money in it ☞

For the gas man.

IT WILL GET NEW CUSTOMERS.

It will KEEP the ones you have.

Negative Advantages:

No "Deposit" is Necessary to Start Business with a new customer. : : :

NO CUSTOMERS ARE LOST on that account.

No Time Lost Making Out Bills.

No Money Lost on account of Unpaid Bills. :

No Disputes on Account of Bills.

THE PREPAYMENT SYSTEM IS PROFITABLE FOR THE GAS MAN AND PLEASANT FOR THE CONSUMER.

OVER 125,000 OF THE POSITIVE PREPAYMENT METERS ARE IN USE IN THE UNITED STATES.

SEND FOR OUR BOOKLET.